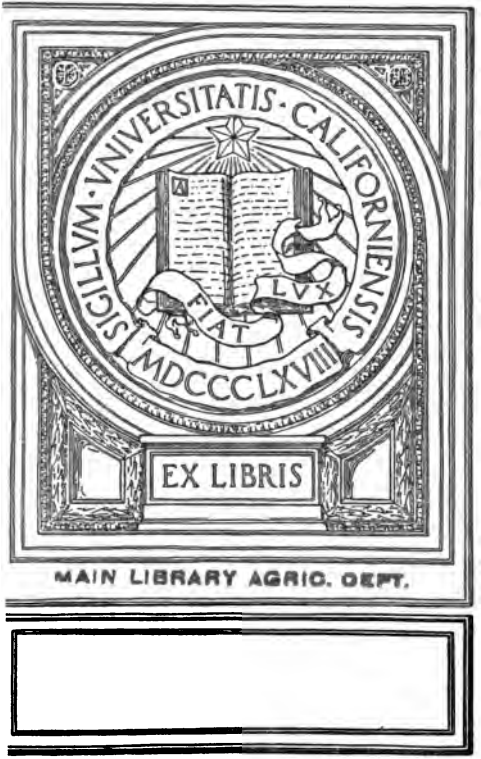
# COBB'S

# S.T.K. MANUAL.



# COBB'S MANUAL.

## IN PRESS.

WEEKS, JORDAN & CO., 121 Washington Street, Boston, have in press, and will shortly publish, the

AMERICAN

# Fruit-Garden Companion,

By E. Sayers, Author of the "*Flower-Garden Companion.*"

This work, as its title imports, is designed to be a Companion to the Cultivator of Fruit, being filled with plain and practical directions for the raising good fruit, and Descriptions of a select list of the best varieties for this country.

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## *New Work for Farmers.*

In Press,

A new work, designed as a practical Companion for the Farmer, in all his operations, by Henry Colman, Esq.—whose employment as Commissioner of Agricultural Survey for the State of Massachusetts, and his own experience, have given him peculiar facilities for making this work one of the best extant.

A

# MANUAL

CONTAINING

INFORMATION RESPECTING THE GROWTH

OF THE

# MULBERRY TREE,

WITH

SUITABLE DIRECTIONS

FOR THE

# CULTURE OF SILK.

IN THREE PARTS.

BY J. H. COBB, A. M.

ORIGINALLY PUBLISHED BY DIRECTION OF HIS EXCELLENCY GOVERNOR LINCOLN, AGREEABLY TO A RESOLVE OF THE COMMONWEALTH.

Ostendens hujus muneris usum.—*Vida in Bombyx.*

FOURTH EDITION ENLARGED.

BOSTON:
WEEKS, JORDAN AND COMPANY.
1839.

Tuttle, Dennett & Chisholm, Printers.

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## ADVERTISEMENT TO THE THIRD EDITION.

Since the publication of the former editions of this little work, the Legislature of Massachusetts having farther noticed it by ordering an additional number of copies to be purchased for further distribution in the different towns of this Commonwealth; and the Congress of the United States having also resolved to purchase 2000 copies for distribution in that honorable body; the author has thought it his duty to enlarge the present edition by giving such further information as he could obtain; and, as late experience has suggested, both in regard to the Mulberry tree and the cultivation and manufacture of silk. He has now in operation all the requisite machinery for manufacturing various kinds of silk stuffs, and has manufactured during the past year several hundred weight of raw silk, and still continues to operate his looms and spindles, although since the repeal of the duties on silk goods, he has been obliged to confine his attention chiefly to sewings and such narrow goods as will sell to profit.

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## ADVERTISEMENT TO THE FOURTH EDITION.

Several years having elapsed since an edition of this work was offered to the public, and repeated applications from different parts of the United States continuing to be made for copies of it, the editor has been induced to enlarge the work by adding in the Appendix considerable original matter, and to submit it again to the public. Ten years experience in the silk business has enabled him to become acquainted with many details which have never been before published, and which may be interesting and useful to beginners. It has also convinced the editor that Silk culture will, in the end, add vastly to the wealth of these United States.

Every silk grower will find it for his interest to have sources of information at hand in every stage of his progress; and although many useful periodicals and fugitive essays are abroad, they do not supply the place of a practical work giving the proper directions in every part of the business. Whether or not such directions are to be found in the subsequent pages, is submitted to the candid and considerate reader.

Dedham, Mass. Jan. 1839. J. H. COBB.

# INTRODUCTION.

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HOUSE OF REPRESENTATIVES.
THURSDAY, FEB. 24, 1831.

MR WHEELER, from the Committee on Agriculture, who were instructed to consider the expediency of encouraging the growth of the MULBERRY TREE, and the Culture of SILK, made the following

## REPORT.

The Committee have examined the subject attentively, and find it to be of much greater importance than was at first supposed. They are surprised to find how great a field is here open, and how long it has been neglected; they are satisfied beyond a doubt, that we have the power to produce and manufacture Silk in this Commonwealth to an immense extent, and that no difficulty is to be encountered either from soil or climate.

The nations of Europe are generally engaged in the culture and manufacture of silk. France, more than any other nation, derives her power and resources mainly from this branch of her industry; her example has induced England, Holland, Germany, Prussia and Sweden to engage with zeal in the same pursuit.

The culture of silk is important in relation to the amount of silk imported and consumed in this country, which exceeds seven millions of dollars, while the amount of bread

stuff exported is on the average less than six millions of dollars!* Facts like these need no comment; yet it is proper that we should bear in mind, that the vast sums thus expended for silk in in its various forms, are paid indirectly to enrich the Agriculture and manufacture of other nations, the raw material of which may be produced here with as much certainty as cotton or any other staple product.

The article of silk has already been produced by a few of our citizens in small quantities, of a quality not inferior to the best imported. Jonathan H. Cobb, Esq. of Dedham, has commenced the culture of silk with success, and has introduced some valuable improvements, especially in the art of reeling from the cocoon, and it is due to that gentleman, that the Committee should remark, that it is from practical information communicated by him, that they have derived some important facts in relation to this subject.

The state of society in this Commonwealth is well adapted to promote the successful culture of silk: it is an employment, in which females and children may be honorably and profitably engaged; with the exception of planting the Mulberry tree, the whole labor may be performed by that class of the community. The Committee feel warranted in saying that so soon as the article can be produced, a good home market will be found at such prices as to afford a profit on the expense and labor bestowed upon it. The White Mulberry tree is easily cultivated, does not require the best soil, serves a valuable purpose for hedges, and is highly ornamental.

The Committee are satisfied that little capital is required to commence the culture of silk, except that capital which consists in knowledge. It is INFORMATION which is the foundation of Agriculture, as well as other arts. Nothing is so well calculated to call the attention of the public to

*See Appendix, G.

this subject as *information* respecting its value, and the means by which our citizens may avail themselves of the advantages which are connected with it; for the purpose of disseminating this information the committee have thought it their duty to report the following resolution,

Which is respectfully submitted.

For the Committee, ABEL WHEELER, *Chairman.*

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*House of Representatives, Feb.* 24, 1831.

*Resolved*, That his Excellency the Governor be requested to cause to be compiled and printed a concise MANUAL, to contain the best information respecting the growth of the MULBERRY TREE, with suitable directions for the culture of SILK,—and that this manual be distributed in suitable numbers in the city of Boston, and to every town in the Commonwealth.—That to defray the expense thus incurred, he be authorized to draw his warrant on the treasury for a sum not exceeding six hundred dollars.

# PREFACE.

In preparing this Manual the author has been guided by the personal experience which he has had for several years in the culture of the Mulberry Tree and rearing of Silk Worms in the State of Massachusetts.

In addition to the instruction which his own practical knowledge in the business has suggested, he has made use of the following works, from some of which he has made considerable extracts, where he found the instruction conveyed was such, as from the test of experience he could recommend, viz.—The Manual published under the authority of Congress; the two first numbers of the Silk Culturist, by Dr Felix Pascalis, of New York; Mr Wm. H. Vernon's abridgment of the large French work of M. de la Brousse; Essays on American Silk, by Messrs D' Homergue and Du Ponceau, of Philadelphia; a pamphlet published by Gideon B. Smith, Esq. of Baltimore, the 22d No. of Dr Lardner's Cabinet Cyclopedia, and Dr Ure's Philosophy of Manufactures. The author tenders his thanks to several of the abovenamed gentlemen for the liberty which they have permitted him to take, as also for many personal communications on important branches of the busi-

ness, which they have suggested to him in the short interviews he has had with them. From two of these gentlemen, of the highest respectability, he has received the subjoined testimonials.

*Philadelphia, 27th June*, 1831.

Dear Sir—I have read with great satisfaction the Manual for the Culture of Silk which you have prepared by order of His Excellency the Governor of Massachusetts, in pursuance of a resolution of your State Legislature, and am well pleased with the manner in which you have treated the subject. Availing myself of the permission you have given me, I have, with the aid of Mr D'Homergue, taken the liberty to suggest a few ideas on the blank leaves of the manuscript, of which you will make what use you shall think proper.

The works of foreign writers on the cultivation of mulberry trees and raising of silk worms, particularly in the latter, are by no means suited to the meridian of this country, and are rather calculated to discourage than instruct our farmers. You have with great propriety discarded their artificial heat, thermometers, barometers, hygrometers, and all their variety of troublesome methods, minute regulations and useless implements, which make the culture of silk a difficult and intricate science. I see no more difficulty in cultivating the mulberry than any other fruit tree; and the art of raising silk worms seems to reduce itself to a few simple rules easy of observance. I know but of one European author who has had the courage to break through the fetters of habit and prejudice; and in a late work on the culture of silk published in the German language at Vienna in 1829, adopted what I call the *American System*, the same which your Manual recommends, and which in fact, has been followed in this country for more than seventy years. The author is the Chevalier von Heint, an Aus-

trian nobleman, the owner of large estates in the imperial dominions. He appears to have completely succeeded, by following this simple American method, and he even ventured to raise silk worms on mulberry trees in the open air, on the frontiers of Hungary, in 44° N. Lat.; and he assures us that he met with the same success.

On the subject of reeling the silk from the cocoons, I think it is an art to be acquired only by practical instruction and experience. It is not to be learned from books alone. The description, however, which you have given of its process, is in general correct, and has been with propriety inserted. It may lead to some useful experiments, and will diffuse, at least, the knowledge of the theory of the art. The present method of reeling silk in Connecticut, will not be long, I believe, persevered in, after a better one shall have been generally introduced. It is well, however, to record it as a matter of fact, and for the benefit of those who still choose to pursue it.

Upon the whole, I consider your work as a good practical directory for American farmers, and as a fair and judicious execution of the duty committed to you.

I am, with great regard,
Dear Sir,
Your obedient servant,
PETER S. DU PONCEAU.

JONATHAN H. COBB, ESQ.

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*New York, June* 29, 1831.

I HAVE read the work of Mr Jonathan H. Cobb on the Culture of Silk, which is intended by him, for a popular manual of instruction, and have been much pleased to find that it unites brevity with all the most important precepts required in that valuable branch of domestic produce. It is also clear and lucid, and free of all accessary details, little to be called for within the short period of time necessary

to make a silk crop. It is evident that Mr Cobb has been many years a practical culturist, and could also embrace the interesting cares of the filature even further than that of making marketable raw silk, which is not frequently attended to by silk growers. It is on this principle only, meaning that of dividing among various branches, hands and stages, all the operations required for the cultivation and manufacture of silk, that national wealth from this rich produce can be depended upon. One only individual cannot be a perfect operative in all stages and divisions of the art, but he can become skilful in many or several of them, if at each degree he command a marketable produce. I conclude with observing that the work of Mr Jonathan H. Cobb deserves the confidence of the public, and its circulation should be encouraged.

FELIX PASCALIS, M. D.

# PART I.

## CULTURE OF THE MULBERRY TREE.

THE only appropriate food for the silk worm is the leaf of the mulberry tree. It should be the first business therefore of the silk grower to provide himself with the source of a constant supply of mulberry leaves. The greater his supply of this article, the greater will be his crop of silk, as the the eggs of the insect are procured to any amount with ease and cheapness. Having the eggs of the insect and a sufficient quantity of food at hand, ordinary care on the part of the proprietor will insure a good crop. It is now abundantly proved that there is no great obstacle in the soil or climate of these United States to raising silk to a vast amount. As there is a difference in the quality of the mulberry leaves for raising silk, it should be the object of the cultivator to propagate the best kind. The white mulberry* has been found su-

* See the leaf, Fig. 1, Plate 2, reduced to one fourth its natural size.

of mulberry trees. New shoots should have ground easy to penetrate. The ground should be ploughed the preceding fall, and again ploughed two or three times in the spring and made light and friable ; two or three dressings of manure well ploughed in would be of essential service; the ground may be levelled with a hoe or rake and the seed sown in drills about the first of May, much in the same way as our farmers sow carrots. The weeds must be carefully destroyed, and in dry times watering will be beneficial. I have sown the mulberries in July, and they have sprouted and come on rapidly, but the frosts of winter in our climate (New England) have been too severe for them. I would recommend to sow the seed in the spring. From a quarter of an acre of ground the last season, I had over 10,000 plants, produced from seed sown in the spring in the way above mentioned, some of them upwards of a foot in height. Those that are intended for transplanting may be taken up in the fall and put out of the way of frost in a cellar, the roots being covered with loam. Those left standing may be covered with light manure or old hay. The frost will be apt to kill the young and tender tops, but the shoots will start from the bottom in the spring with great luxuriance. The seed plant is undoubtedly best, both for food, for worms and duration: it is also the most convenient mode of getting the trees, as seed enough can be sent by mail to any part of the Union to produce an or-

chard sufficient to feed several millions of worms. I cannot believe that any other mode can be pursued to much advantage in this country; but as some may be fond of trying experiments in other modes of culture, the following are laid down as sometimes used in Europe.

### MANNER OF MULTIPLYING MULBERRY TREES BY CUTTINGS.

The soil chosen to receive the slips of the mulberry tree should be prepared much in the same way as has been described for the seed. The cuttings of the mulberry are to be planted in the same manner as the cuttings of the vine; that is, by making furrows by a line at the distance of six feet from one to the other, and by crossing them by furrows at the same distance, in order to form squares. A two-year old branch of a mulberry tree, having wood of four or five years at one end, must be selected, and the extremity of the old wood must be interred to the depth of about ten inches. The branches chosen from the white mulberry must be taken off in the spring at the first rising of the sap. Two or three incisions must be made in the joints or knots of the old wood, because this operation will facilitate the shooting of the roots, which always put forth from the joints of the old wood. The cuttings must then be covered with a well manured and friable earth, and the end of the branch which rises from

the soil must be cut off at the third bud from the surface. If rains should not frequently occur after the plantation is finished, it would be necessary to water the plants often. The multiplication of mulberry trees by means of cuttings is said to have the important advantage of two years in advance over the establishment of a nursery by means of seed in Europe.

### BY LAYERS.

To make layers is to force a branch or a shoot of a tree or of a shrub to become itself a tree or a shrub, by putting a branch or a shoot into the ground without separating it from the parent tree. The spring is the most suitable season for this operation. The shoots which arise at the foot of a a tree, the youngest smooth branches found about the lower part of the mulberry, any other branches that are long and supple enough to be secured in the ground, and lastly, the shoots of a young tree whose trunk is not high and which may be laid easily, may be used. If there arise some vigorous shoots at the foot of a mulberry tree, a hole must be dug six or eight inches deep near each shoot, into which the shoot must be laid without twisting it or separating it from the tree. It is then to be secured in its place with crotchets of wood and covered with good mold, which must be pressed over it, and the end of the shoot which rises above the ground must be cut off above the second

bud. It will be further necessary to place by the side of the layer a stake to mark the place and prevent its being trodden. It must likewise be watered immediately after the operation, and as often afterwards as may be necessary to maintain about it a proper state of moisture.

The young and smooth twigs among the branches of the mulberry may be passed through a basket or vase perforated at the bottom and filled with earth well manured. The twig must be cut off four or five inches above the vase or basket, and the mold kept in a due state of moisture by frequent waterings.

When a mulberry tree is well spread and the boughs nearest the ground have not been lopped, some of the branches at the distance of six feet from each other may be bent down and secured in the ground, so that the ends shall not rise more than six or eight inches above the surface.

All the layers made in these different ways may be separated from the parent tree in the autumn of the second year. They may be cut off four inches from the parent trunk, be taken up carefully with their roots and small fibres and placed in the nursery, or permanently established in an orchard. In the nursery they may be set at the distance of six feet from each other, and in the following year, by heading them down, four or five layers may be made from each. By these means one hundred

trees may be increased in four years to eighteen hundred; for the parent trees, after the layers are separated from them, being replaced in a straight position, secured to a prop, manured, and watered, generally retrieve their strength and make productive trees.

### TRANSPLANTING FOR HEDGES.

After standing in the nursery a suitable time, the trees may be transplanted for making hedges. I prefer transplanting in the spring. Great care should be taken to preserve the very fine roots. If hedges for fences be wanted, the young trees may be taken from the seedlings of the last year. The white mulberry forms an excellent live fence, and when once established is probably the most permanent of any other. Cattle must not be allowed free access to the hedge while young, as they would destroy it altogether; but after it has become a good fence they may approach it with advantage. The more it is broken and lacerated by cattle, the more impenetrable it will become; as, for every branch broken, a half dozen shoots will immediately start out, till the bush forms a perfect bramble. This mode is therefore recommended as accomplishing three important objects: supplying food for silk worms; keeping the trees low, that the leaves may be gathered from the ground by children, and furnishing a good and almost never ending fence. In transplanting young trees for

hedges, they should not be pruned; but the second year, or at least the third, the tops should be cut off and the side branches trained laterally with the hedge by interweaving them.

### SETTING OUT STANDARD TREES.

It is an axiom in rural economy, that the greater the disbursement in improving the land the greater will be the proportional income. The land where the trees are to be set, will be much better for the purpose if ploughed, harrowed and manured. The trees may be three years old if taken from a rich soil, or four if from a poor soil; they should be from four to eight feet in height, and at least an inch in diameter. The holes should be dug at about the same distance from each other as for setting apple trees, and be made eighteen inches deep and three or four feet in diameter. The bottoms of these holes may be covered with a few inches of fresh mold. The young tree should be placed in its proper range, ascertained by a stake at each extremity of the line, and it should be held there till its roots are well covered with friable and well manured earth, free from stones, and must be well trodden down and watered if necessary; a small cavity round the stem to retain the rain is very proper. Two or three dressings a year with a hoe and manuring occasionally may be of essential advantage.

### GRAFTING AND BUDDING.

In grafting it is essential to adapt the bark of the scion at its extremity to the bark of the stock, and to place the scion on the northerly side in order that it may be less exposed to be withered and dried by the sun. Budding should be performed with the same care as in other fruit trees in order to insure success. But these and many of the modes of improving and propagating the mulberry, which have been resorted to in Europe, will be unnecessary in this country. With us, land is so cheap and labor so high, that the easy and convenient mode of propagating by seed will be chiefly resorted to, and no essential permanent advantage will result to us from grafting or budding, except in propagating the rare varieties.

### PRUNING.

The imperfection in the form and growth of the trees may be remedied by a judicious pruning, once in two or three years; and with regard to that, the good sense of every cultivator will direct him how to form a tree the most beautiful, as well as the most productive. June is the best season for doing this, and the young branches that are taken off will afford their leaves for the worms.*

* For taking off the small branches of larger trees which could not be reached by hand, I saw an ingenious contrivance at

GROWTH OF THE MULBERRY TREE.

Standard trees, when once well rooted, will thrive in a soil that is not too wet; the giganic size to which the wild native mulberry attains in the western country, and numerous examples of large and thrifty trees in the Atlantic states, furnish abundant evidence of this. The mulberry tree attains to a very great age, and no other tree of equal growth and beauty resists so well the influences of the sea atmosphere. Two or three grand specimens of this beautiful tree, says Mr Phillips, standing on the most exposed situation of the northeast coast of England, not only defy the enemy, but delight in their situation: throwing out their noble limbs in all directions, and assuming a foliage rich, full and tufted to its topmost boughs: one of them is of the greatest magnitude, though some of its vast limbs have been torn from it; it is still in vigor, and in point of richness of effect, the oak is scarcely superior. They are abundantly prolific. The red, or, as it is more commonly called, the purple mulberry, is considered as the only species indigenous in this

Baltimore by G. B. Smith, Esq. It was nothing more than a pair of pruning shears attached by one of the handles to a ten foot pole, which is held in one hand, and operated upon by means of a cord passing through a pulley, and attached to the other handle with the other hand; by this simple contrivance the twigs and branches were taken off with ease, and so smoothly as not to lacerate the bark or injure the appearance of the tree.

country.* The northern extremity of Lake Champlain is, according to Michaux, its most northern limit. It is found in all the states of the Union, south and west, and Dr James found it as far west as the river Canadian.

Every thing is useful in the mulberry tree. Its leaves are valuable in the silk which they produce by nourishing the silk worm; its fruit is excellent for poultry, and the wood is useful for the joiner and for fuel. The mulberry tree may also serve as an ornament to our gardens and streets, very different from the Lombardy poplar, which harbors a loathsome insect, or the elm, or the ash, which are barren, and do not afford so thich a shade; and as this tree is always handsome and useful, the Author of nature has been pleased to add cleanliness, as on account of the acrid bitterness of its sap, but few insects will harbor upon it.

The first mulberry tree that was planted in France, was near Montelimart, and nearly three centuries after (in 1802) the original tree was still in existence.

In England it was first planted in the year 1548; Mr Phillips saw at Sion House the original trees. He found the interior so decayed that the timber crumbled on being touched: the propped branches were nevertheless so well nourished, that the fruit and foliage were not inferior to those of the young-

* See the leaf in Figure 2, Plate 2.

est trees. Of the plantations formed during the reign of James I. many venerable remains are still seen in England. Mr Phillips found a black mulberry tree in a garden adjoining Greenwich Park which is supposed to be one of the oldest in England. 'It throws out,' says Mr P., 'ten large branches so near the earth that it has the appearance of half a score of large trees, rather than one, and notwithstanding many of the projecting branches have been sawed off, it completely covers a circumference of one hundred and fifty feet; and although the elder trees have fixed their abode in some parts of the trunk, and other parts are covered with ivy, it continues to give shoots as vigorous as the youngest tree, and produces the finest mulberries in England. It is a regular bearer, and the gardener assured me that he gathered more than eighty quarts per day during the season.

### THE CHINESE MULBERRY.

Besides the varieties of the mulberry tree heretofore mentioned, there is one, which, if we may believe the recommendations of it, is superior to all others for the culture of silk: I mean the Chinese mulberry.*

The following account of it I derive from the second No. of the Silk Culturist, a valuable and use-

*See the leaf in Fig. 3, plate 2, reduced to one twelfth of its natural size.

ful work, published by Dr Felix Pascalis, of New York. It is contained in a letter to the author from Havre.

'Samuel Perrottet, a member of the Linnæan Society of Paris, employed by government as a travelling botanist, returned to this port after a voyage of thirty four months. He brought with him eighty four boxes of various dimensions, containing one hundred and fifty eight species of living plants, of at least eight feet in height, to the quantity of five hundred and thirty four individuals. All these productions had been procured in the seas of Asia, or gathered on the coast or in the lands of Cayenne. From the commencement of the present century, there had never before been so vast an importation — one so extensive in number, for rare genera, species and families, and vegetable productions, or of their seeds. All of them passed under my examination, and they rather appeared to have come out of a green house than from a ship.

'In this immense collection was the *Morus multicaulis*, thus called by Perrottet, for the first time ascertained to be the real Chinese mulberry, *Morus alba sinensis*, of which every silk grower and culturist should endeavor to multiply the species. It has been deposited in the Royal Garden. Monsieur Perrottet says that it grows with many shoots from the roots, with tender stems and large foliage, of a much more nourishing nature than the European mulberry.

'Chinese inhabitants assured him, that to this tree the disciples of Confucius are indebted for the prosperity and solidity of their empire.

'The *Morus multicaulis* is already propagating in many parts of France, and probably will be substituted and preferred to all the other varieties. Among the other qualities of the plant, it is affirmed in China that a less quantity of this foliage is required for the precious insects than of that which we are obliged to provide for them.

I obtain the following additional particulars in regard to this variety, and also that of the Dandolo mulberry, from Mr Kenrick's valuable treatise on fruits, just published.

MORUS MULTICAULIS.

This is a new and most valuable species of Mulberry, for the nourishment of the silk worm, which is represented as possessing such decided superiority over all others, as to be speedily substituted for them in every region of the globe.

This tree has not yet to my knowledge borne fruit in America. It was even unknown in Europe as a fruit tree, till in 1830, for the first time, it produced its fruit in France. The fruit according to M. Audibert, was produced in great abundance; it was long, black, and of sufficiently beautiful appearance; its taste very good, having a taste intermediate between the red and black mulberry. The

tree is very vigorous and upright in its growth. The leaves, in a light, friable, rich, and humid soil, are large and cordiform, but in a dry and arid soil, they are of less size, elliptical, and without the heart shaped indentation; their breadth is stated to be six inches, and their length eight; but in rich soils they are sometimes eight inches in breadth, and ten in length, or even more. They are curled or convex on their surface, of a deep shining green, and eminently beautiful.

REMARKS on the culture and uses of the Morus Multicaulis, by M. Perrottet, Agricultural Botanist, and Traveller of the Marine and colonies.—From the 'Annals of Fromont.'

'The *Morus Multicaulis* which we noticed for the first time in the *Annals de la Societie Linnenne de Paris for* 1824, appears to have originated in the elevated regions of China; from whence it has been disseminated throughout the low plains near the sea shore. It is believed it is cultivated in all parts of that vast empire, where the education of the silk worm is an object of commercial importance. From Canton it was introduced into Manilla and all the Islands in the Asiatic Archipelago, where it was only cultivated for ornamenting gardens. The Chinese are entitled to the credit of this introduction, who in emigrating from their country have from motives of industry, endeavored to multiply it, that they might render it useful to them in the new country of their adoption.

'The fortunate discovery of this precious shrub occurred in the garden of a Chinese cultivator at Manilla, who, after having informed us of its properties, and the important purpose for which it was used in his own country, yielded to our solicitations and sold us two bushes for ten Spanish piastres, assuring us that he had introduced it into Manilla, where it had been considerably extended.

'In August we brought it from Manilla, the capital of the Phillippine Islands, and first introduced it into the Isle of Bourbon, from thence into Cayenne and France. At a later period it was sent from Cayenne to Martinique, and from France to Guadaloupe, and also to Senegal, where it has been considerably multiplied. The numerous plants which are already disseminated in the divers climates of Africa, America, and Europe have been all produced from the two individuals, which we procured at Manilla.

****'Among the number of mulberries, now cultivated by the Chinese, for the education of silk worms, the *Morus Multicaulis* appears to be the most esteemed of all, not only for the facility with which it is propagated and grows, but still more for the essentially nutritive property which the leaves possess. We have been enabled to verify this important fact during the five years which we passed in Senegal.*** The characters which essentially distinguish this mulberry from the other varieties

are those which result, 1st, from the remarkable property which the roots possess of throwing up numerous small flexible stalks, without forming a principal trunk; 2d, from the great length which these stalks assume in a very short time; 3d, from the remarkable development which the thin, tender, and soft leaves speedily acquire, and the promptitude with which they are renewed.* * * And 4th and lastly, from the extraordinary facility with which the stalks and branches strike root, as cuttings, without particular care, even before they have acquired a ligneous consistence.

* * * 'Besides the advantages which we have already named, we may still add, that they are admirably calculated for forming regular plantations; it not being natural to grow tall or form any trunk properly so called; they can be placed very near without an injurious effect; and by heading down the stalks annually near the ground, a rich vegetation is produced, with a complete development of vigorous branches and leaves; and finally it is easy to multiply them by thousands from the roots in the course of a year and to form vast and regular plantations of them the second. But a few years then are sufficient to obtain considerable fields of them in full vigor, sufficient to support an immense quantity of silk worms, and that with the greatest facility, as they are reproduced in a manner almost indefinite. * * * Regular plantations of it can be

formed without difficulty, by planting the shrubs at a distance of six or eight feet from each other, a space sufficient for the extension of the branches, to facilitate the culture and for collecting the leaves. This last operation is so much facilitated by the flexibility of the stalks, that a child is sufficient for furnishing the food of a large establishment of silk worms.

CLIMATE, SOIL, &c.—* * * ' This species will be readily acclimated in Europe; because it originated in an analogous region as to climate, to that which we inhabit. It appears not to suffer from the excessive cold of the northern, or the intense heat of the intertropical regions; for the plants deposited in the gardens of the government at Cayenne, acquired in the space of eight months a truly remarkable development, and at the time of our departure from that colony, in June, 1821, they were clothed with leaves of an extraordinary size. Those also which we cultivated at Senegal, although situated under a dry and scorching sky, and planted in an arid soil, offered an appearance sufficiently satisfactory, but they had acquired less development in all respects, than those which have vegetated under the humid climate of Guiana. It appears expedient then, that plantations of this mulberry should be made upon a humid rather than a dry soil, to obtain in all respects a satisfactory result.

* * * * ' Besides, this mulberry braves the most

vigorous winters. We saw on our arrival at Havre, in July last, in the field of M. A. Eyries, plants, which had endured, in the open ground, the winter of 1828, and which appeared vigorous and beautiful.'—Thus far M. Perrottet.

On this last and other points, let us now hear the testimony of M. Poiteau in the *Annales d'Horticulture*, 1830.

'By the information which we receive from all quarters, it appears that this mulberry is destined to replace the common white mulberry, everywhere for nourishing silk worms; its property of continuing low and bushy, so that the leaves can always be gathered without a ladder; and the large size, abundance, and tenderness of the leaves, cannot fail to give it a decided preference. It has been sufficiently ascertained, that they are eaten with avidity by the silk worms, and that the silk which they form is of the first quality. This mulberry has not suffered in the least from the rigors of the last severe winter.

'The zealous traveller, who has given to France, America, and Africa, this precious plant, has acquired a just claim to public gratitude, and it is not only easy, but proper, to give him at this time a proof of it, by affixing his name to the tree which has given him celebrity, and which will contribute so much to the prosperity of French Industry. ***' *Note to the Perrottet Mulberry* (*Morus Multicaulis.*)

M. Audibert is also decidedly of the opinion that the best mode of cultivating the *Morus Multicaulis*, for the support of silk worms, is in hedges with low stocks. M. Barthere of Toulouse in the South of France, who has considerably extended their cultivation, fully coincides in the same opinion; and is confident that in grounds and vineyards which could hardly give two per cent., this tree will now insure ten per cent.

This tree, according to M. Perrottet and Dr Deslongchamps, is easily propagated either by layers, by cuttings, or even by cuttings of a single eye, placed beneath the surface and shaded from the noonday sun.

The experiments instituted at Paris by Dr Deslongchamps, have confirmed all that had been previously asserted respecting the quality of the silk produced by this plant; he has further stated that the cocoons, made by the worms fed only on this plant, are even rather heavier.

Dr Felix Pascalis in an article in Silliman's Journal of Science for July, 1830, after informing us that in the preceding March he had received two plants of this mulberry from France, has added — 'After the discovery of this plant, a doubt no longer exists, that two crops of silk may be raised in a single season.'

At Madam Parmentier's Horticultural establishment, two crops of silk were produced in the sum-

mer of 1832. The first were fed promiscuously on the *Morus Multicaulis*, *Morus Alba*, and other mulberries. The cocoons thus produced were about two thirds white and the remainder of an orange color. A suitable portion of these cocoons were collected for seed, having no regard to color:— These being subjected to the hatching process, produced a second crop on the 30th of July. These last were fed exclusively on the *Morus Multicaulis:* they passed through the different stages of their larva existence in the short space of 26 days. The cocoons which were obtained from this second crop were of a *much larger size* than those of the first crop, but what is of still more consequence *they were of the whiteness of snow, and have a most beautiful shining appearance.* (See New England Farmer, vol. xi. No. 2.) At Madam Parmentier's in 1831, I witnessed the silk worms feeding with avidity on the leaves of the *Morus Multicaulis*, and was informed that they had left eleven other species of mulberries to feed on this. At that place we are also informed, the *Morus Multicaulis* has withstood the rigors of the last six winters uninjured and unprotected. Although being possessed of an active and prolonged vegetation, it is not to be expected that the unripened wood of the tender tips should always escape.

I introduced this plant to Massachusetts in the spring of 1821, from the Messrs Prince of the Lin-

næan Botanic Garden, Flushing; I also received plants of the same from Madam Parmentier's of Brooklyn, L. I., and I have also received them from France from M. Andre Michaux, author of the *American Sylva.*

CANTON MULBERRY.

This mulberry has been cultivated with great success at Northampton and other places in the New England States. I had some of this variety in the same field with the Multicaulis, which survived the last winter's exposure, when the last named did not. Dr Stebbens, a judicious cultivator, has the following remarks, as the results of his experience.

Respecting *soil*, *situation*, and *exposure:* I have found that our *poor*, *light*, *dry*, and even gravelly soil, is better adapted to the culture of the Multicaulis, than our richest lands. The *location*, or *situation*, should be high, or elevated above the danger of water collecting about the roots.

On such soils, although the trees would not attain the height of trees grown on rich land, yet the foliage would be more numerous, and the chance of having the trees ripen, or form hard wood for cuttings, and sustaining our winters, would be enhanced.

Respecting the *most valuable mulberry* for cultivation; its *capability* to endure the *cold* and *frost;*

the *quantity* and *quality* of foliage; *labor* of culture, and *stripping*. These questions will be answered with reference to this climate; and will include not only my own observation and experience, but the experience of others of my acquaintance, in whose opinions I have the utmost confidence.

I commenced with the Italian white mulberry, and have used also, the *black* and *red* mulberry; each of which requires good soil, no matter how rich. I found that, although the worms would feed well on these, yet they were equally fond of the Multicaulis, which was selected for its large leaf, nutritious quality, and tender fibre, which the worms can eat, while the fibres or ribs of the white mulberry are so ligneous as not to be edible. Eighty pounds of Multicaulis foliage are considered equal to one hundred pounds of the Italian white, for feeding worms.

The tree or shrub commonly known as the Multicaulis, was found in a garden in Manilla, cultivated as a tree of ornament, and, to distinguish this from all other mulberries, is now called the *Manilla multicaulis*, and particularly to distinguish it from *another tree*, more deserving of *multicaulis*, on account of its capacity to produce more numerous stalks and branches.

Although the *Manilla multicaulis* has a very large leaf, grows rapidly, and the silk worm is fond of it, yet, in consequence of its rapid growth, the

stalks are often so green and tender, that when overtaken by early frost, they are liable to be injured, before the wood had been sufficiently formed to endure cold and frost.

Nevertheless, the *Manilla* multicaulis is so valuable a tree, that experienced cultivators have told me, that if it should become necessary to take them up every autumn, protect them during winter, and reset them every spring, it would be much better than to cultivate the white mulberry; and that the culture of an acre of mulberry would require no more labor and expense than that required for an acre of Indian corn.

But there is another mulberry alluded to—the *Canton* multicaulis—so called from the place of its derivation, being the product of seed which the *Canton mission* were requested to procure, being considered the very best and most approved mulberry used by the Chinese; and it is believed to be the first genuine seed ever imported into this or any other country. It was obtained under very favorable circumstances, such as have not often occurred; and the same mission have recently forwarded more seed for next spring's use.

That the *Canton* multicaulis is the true kind used by the Chinese, is made evident from a set of historical paintings from China, and from the seed growing at the foot of the stalk, different from other mulberries.

From the experience I have had, I concur in opinion with those who have cultivated the several kinds of mulberry, that the *Canton* multicaulis is deserving of the first consideration, and to be preferred to all others; not only on account of its equal capability of enduring cold and frost, but from the number, quality, and size of the leaf. Although not so large as the Manilla leaf, yet a leaf of the same size is considered much heavier than the Manilla—some say double the weight.

I have cocoons in possession, made by worms which were fed exclusively on the foliage of the white mulberry; and another parcel fed exclusively upon the foliage of the *Canton*. The latter have a lustre and brilliancy far surpassing the former; and the difference is nearly as great as between the merino, and wool of native sheep.

It is the opinion of horticulturalists, and those best acquainted with the propagation of trees or plants from seeds, that trees from seeds withstand the severity of climate better than trees propagated by any other mode.

Another circumstance occurred last autumn, in favor of the *Canton:* I had the *Canton* and *Manilla* trees, and another kind, called the *Asiatic* seedling, growing side-by-side in my garden, each having the same exposure to an untimely and severe frost; when the *Manilla* was much injured, the *Canton* and *Asiatic* escaped unhurt; and two

other kinds, called the Chinese and Smyrna, were uninjured.

These seedlings, we hope, will be a most valuable acquisition to the list of mulberries adapted to the feeding of worms, and enduring the cold and frost; nevertheless, great caution is necessary in the use of imported seed; for instance, seed grown upon the Multicaulis tree, will not produce a plant like the original tree; at least, it has so proved under my observation. The leaf is different in shape, and not one fourth so large as the original; neither do the seeds produce trees which furnish a uniform leaf in shape or size. There is often deception in seed procured at foreign seed-stores; sometimes the vitality of the seed is destroyed, or otherwise injured by neglect. For these, and other reasons which might be offered, purchasers of seed have been disappointed, and the mulberry cause injured; because they have expected too much, or that by the seed of a certain *name*, they should obtain the genuine tree. The peach, apple, and some other trees, from seed or stone fruit, when planted, produce a great variety; perhaps not one seed in a thousand shall produce a tree in all respects like the original. It is advisable to have no dependence on the seed, but to procure trees which have developed the true character.

Having mentioned the *Canton* mulberry as first

on the list, yet some, who do not know the Canton, would have the Manilla stand at the head of the list of the most valuable mulberries. The *Asiatic* and *Chinese* may be the next best, on account of their capability of enduring cold and frost; the leaf of which, in shape, resembles the *Canton*, but not so large; each of which, however, on account of the numerous buds on the stalks, may produce as much weight of foliage, and of as good quality, as the Manilla multicaulis of the same age. But should the Manilla multicaulis utterly fail of acclimation in this latitude, resort may be had to the *Canton*, *Asiatic*, *Chinese*, and some others which have been propagated from the seed, and give fair promise of adaptation to this climate.

In a more favored clime, the last year, these trees attained a much greater height, and larger leaf, than in this place.

Respecting the *best mode* of cultivation, *stripping*, *value*, *expense*, and *profit*, of an acre of mulberry, I shall not only communicate my own experience, but that of the most skilful cultivators of this region.

In *this climate*, the culture, setting out mulberry roots or cuttings, commences at the usual time in making our gardens, after the spring frosts, and when the earth has been suitably warmed by the sun—last of April or beginning of May; and soon as the foliage has grown to the size of an apple-

leaf, or the full size of the white mulberry leaf, (about the 15th or 20th of June,) the eggs may be brought out for hatching; and, if they can be kept back, so as to be hatched at different times, as the foliage multiplies, the cultivator will have the advantage of several crops in succession from the same lot of eggs—a much better way than to breed *in*-and-*in*, as it is called. Eggs may be preserved during winter in a cool place; freezing does not injure them; but before spring, they should be secured in glass bottles, corked tight, to exclude the external air, and each bottle of eggs put into an ice-house, placed on a *cake* of *ice;* if set upon a shelf they would hatch, even in an ice-house. Eggs thus secured, may be kept back, and save much labor, time, and expense. As one class of worms are advanced, another can succeed them on the same shelves or hurdles. In this way, the same number of trees would feed double the usual quantity of worms.

In gathering the foliage, the buds must not be injured, nor the extreme ends of the limbs deprived of the leaves, leaving two or three leaves at the end untouched; commencing on one side of the field, and when once gone over, there will be a new crop of leaves ready at the place of beginning; and thus the foliage may be gathered several times from the same shrub or tree, whether the product of a root or cutting. I had roots and cut-

tings set out last spring, the foliage of which was gathered three or four times from the same trees, without injury; indeed, the trees apparently grow better by having the leaves taken off so frequently, always leaving the buds uninjured, and the extreme ends of the branches without stripping. Instead of stripping the leaves, each leaf should be taken separate; if the bud should be injured, it would be spoiled for a cutting, or even foliage. Frequent defoliation of the mulberry does not injure it, although such treatment would spoil some other trees.

When trees are started from cuttings, it will often be found that a shoot will grow several inches before there is any root formed; in this case the support is derived from the atmosphere, instead of any assistance from the root, as is usual with other trees.

Vegetables of rapid growth are said to perspire their weight in twenty four hours; this rapid evaporation or perspiration will account for so many cuttings failing to become trees; the leaves become discolored, wilt, and the plant is ruined. But to avoid this, let the cuttings be watered in dry weather, and take off the leaves until roots shall be formed.

Respecting the *cultivation*, the earth may be stirred or the trees hoed so frequently as to prevent the weeds growing; but not after the first of

August, that the trees may have opportunity to form wood; and the location must be so elevated and dry as to be out of the way of water settling near the plants.

Respecting the *value* of an acre set with mulberry, it depends on the price of the mulberry and number of trees set therein. If the trees are set 2½ feet apart in the rows, and the rows 3 feet apart, an acre would take 6,808 trees, which, at 25 cts. each, would be worth $1,452. Some prefer to have the rows 4 feet apart, and 2 feet apart in the row; in this case it would require 5,445 trees to the acre. But provided an acre of ground shall be set with cuttings, the rows 2 feet apart, and 1½ feet apart in the rows, 14,520 cuttings might be set in an acre, which, at $30 cost per 1000, or 3 cents, would amount to $553 60 to stock an acre. It may be understood that a purchaser wishing to stock an acre of ground, the trees and cuttings could be purchased at a less price than above stated.

Taking into consideration the number of trees the most proper for an acre, and a reasonable price for the trees, the *average* price of an acre of land set with mulberries, including the land, might be worth from 750 to 1000 dollars investment.

The *cultivation* of an acre of mulberry would, of itself, be no more than that of an acre of corn; but, including the *gathering* the leaves, *feeding*

the worms, and *reeling* the silk, need not exceed 200 dollars. The *profits* of an acre of mulberry would depend upon the fidelity with which the worms are fed, and the quantity of raw silk made from the cocoons.

Some cultivators assert that an acre of ground set with mulberry will, the second year, produce foliage sufficient to feed 1,000,000 of worms, and that number of cocoons will make 333½ lbs. of silk. I have no personal knowledge of one acre having been set apart for that purpose; but from experiments made with a certain number of trees, in proportion to the acre, it has been ascertained that 100 lbs. of raw silk may be made from an acre the first year of setting out; and if the roots can be preserved without removal during the winter, a much greater quantity of foliage would be furnished, and, of course, a greater quantity of silk might be made the second and third year; so that the maximum might be 300 lbs. or more of silk to the acre. But assuming the minimum quantity, (100 lbs. from an acre,) it would yield the cultivator a greater profit than from any other product from the soil.

The last year I requested several cultivators to make thorough experiments to ascertain the *certain* profits of an acre. Only one, however, met the application with the precision desired. He by strict economy of time, labor, and expense, al-

though he gave *three* dollars per week and board, to two experienced females, as teachers in gathering foliage, feeding worms, and reeling silk, found that his silk cost him only *two dollars* the pound, and estimates his silk worth at least six to seven dollars the pound, on account of excellency of the reeling, for which he has the liberal bounty of the State, and also a premium from the Agricultural Society. The quantity and value of silk depend on the skill and perfection of reeling.

The value of *American* silk far exceeds the imported raw silk, not only in lustre, but strength of fibre, and the small comparative waste in the manufacture; and is probably worth 25 per cent. over the imported article of raw silk.

The same cultivator informs me that, the last year, being a year of experiment, attended with loss of time and expense, which he can avoid another year, he feels confident that he can hereafter make raw silk at $1 50 per pound.

Respecting the most valuable silk worm:—Perhaps the large grey or black one-crop worm on all accounts is equal to any other. There are several varieties of worms—one called the *two*-crop worm; but one good yield is worth more than two poor ones, with imperfect cocoons.

In China, where several crops are taken in succession, from hatching eggs of the preceding crop,

it has been found that the quality of each succeeding crop of silk is deteriorated, and that silk grown in an elevated or northern region of China, uniformly commands or obtains 20 per cent. more for any quantity of silk, than for silk grown in the warmer latitudes; and for the same reason that American silk is superior to that imported. It has been thought that the Chinese seldom or never export the silk grown in the cool regions, but that it is retained for the superior fabrics. Eggs, to be of good quality, must have the maturity of age. The usual time of hatching the first parcel of eggs, in *this climate*, is from the 15th to the 20th of June, or as soon as the mulberry leaves have a size to commence gathering. 3000 worms, (or even 2000 or 2400, if well attended,) will make cocoons sufficient for one pound of silk.

The *quantity*, *quality* and *value*, and *market* of cocoons, depend very much on the attention of feeding the worms, ventilation and cleanliness of the cocoonery; in cold seasons the worms do not make so perfect cocoons as when the weather is mild during the time of feeding.

As to a market for cocoons, the several silk factories and reeling establishments will readily purchase or reel them on hire; and that the producer should receive the benefit of good cocoons, instead of purchasing by the pound, a fair price would be

given for any quantity yielding a pound of silk. The cultivator must, therefore, see the propriety of so faithfully feeding the worms as to produce hard and sound cocoons.

But the cultivator would derive the greatest profit by reeling his own cocoons, as every family might do with very little expense.

The Legislature of Massachusetts give a generous bounty to encourage the growth of silk—about sufficient to cover all the expense of gathering the leaves, feeding the worms, and reeling the silk; so that every pound of silk raised and made in Massachusetts may be considered a clear profit to the cultivator: rent of the land, taxes, and interest of investment not included. Nevertheless, even these items may be overcome in a very short time.

### BRUSA MULBERRY.

This is a hardy plant, and will stand the climate in our latitude. It was introduced into this country by Charles Rhind, Esq. who brought the seed from a city in Turkey, whose name it bears, which is situated at the foot of Mount Olympus, the summit of which is covered with perpetual snow. The seed was planted and the trees cultivated by David Ruggles, Esq. of Newburg, N. Y., and are also growing on the silk farm of the Hon. Ambrose

Spencer, near Albany, N. Y. The plants are short jointed, the leaves large and thick, and will probably stand a more northern climate than the multicaulis. I am informed that a supply of these plants will soon be furnished by Judge Buel, and the nursery men in that vicinity.

### DANDOLO OR MORETTI MULBERRY.

A new and most valuable species of mulberry for the nourishment of the silk worm. It was first discovered about 1815, by M. Moretti, Professor in the University of Pavia, and from a single young tree he had in 1826, multiplied them to 120,000. The tree is presumed to be hardy; the fruit which is at first violet, becomes at maturity perfectly black. The leaf is ovate, sharp pointed, entire, cordate at the base. It is thin, smooth on the under and especially on the upper surface, which is of a beautiful and rather deep shining green; it is not near so thick as that of the large white mulberry, called in France, the *Admirable*, and is thinner than those of the Spanish mulberry, (*Morus Nigra.*) It is neither wrinkled or plaited. It is in general nearly eight inches wide, and ten inches long. This mulberry will be most profitably cultivated in the form of a hedge, and from the superior size of the leaf, they are gathered with the greatest facility. Its superior quality has been proved by the experiments of M. Gera and Count Dandolo, who assert that they

produce silk of a more beautiful gloss and of finer quality than common silk.*

The following statistics of a mulberry orchard of two acres, are by the late Andrew Parmentier, Esq., of New York ;

650 standard trees in the low parts of the ground, each 20 feet apart.
250 standard trees on the rising places, 12 feet apart.
650 dwarf trees on suitable portions of the ground.

1550

This ground to be fenced by mulberry hedges. The purchase money for about two acres, with cost of manure and necessary tillage, is estimated at $500.

Supposing that to secure full success to this orchard by using none of the foliage, and tilling and replacing dead trees during five years, counting loss of interest and other expenses accruing, we have an increase of debt of $375, and a capital of $881 ; but commencing from the fifth year up to the twentieth of its existence, the author of these statistics forms three different periods of five years each. The plantation will give in the first period

* See the whole article inserted by the Hon. H. A. S. Dearborn, in the New England Farmer, vol. viii, No. 29. It is from the Annales d' Horticulture, and is extracted from the Report of Dr Fontanelles, on a letter published by M. Gera in 1826, in the Journal of Physics, and of Chemistry of Pavia.

from 90 to 95 quintals of foliage, that is 9000 lbs. or fodder for five ounces of worm seeds; 35 pounds of silk, about $180, that is, 20 per cent. on $881. The second period will annually afford for fourteen ounces, 15,000 quintals, or 95 lbs. of silk, equal to 47 per cent. on $881. But the third period to the twentieth year of age of the orchard, from 500 to 650 quintals may be expected, which will feed 28 ounces and give 196 lbs. of silk, worth nearly $1000, or more than 112 per cent.

The following are remarks and calculations of my estimable friends Messrs Abner Brownell and John Macomber of Westport, Mass. who are engaged in the cultivation of the mulberry tree, and have a large number of them of various sizes for sale. I furnished them with buds of the Morus Multicaulis, from my nursery last season. Although it is very evident that all calculations on these subjects must be uncertain, yet I have thought the following from judicious farmers might not be unacceptable.

Mr J. D. Homergue in his letter to the Hon. Andrew Stevenson, Speaker of the House of Representatives in Congress, says — 'In one acre of land there are 43,560 square feet, on which may be planted 3000 mulberry trees, (from 4 to 3¼ feet apart.) These will yield at the age of seven years, 90,050 pounds of leaves, — 30 pounds to a tree — producing 7,500 pounds of cocoons. At 25 cents

per pound, these cocoons would sell for $1,875; at 40 cents, $3000; at 50 cents, $3,750.'

In Fessenden's American Gardener, page 272, it is said, 'one ounce of seed will produce about 40,000 worms, who consume about 1000 pounds of leaves, and produce from 80 to 100 pounds of cocoons; and 12 pounds of cocoons give about one pound of Silk.' In the Franklin Journal, vol. ii. pages 22, 94 and 139, Count Dondola says, 'The quantity of leaves actually consumed by 200,000 worms, is, in the first age, 20 lbs. second, 55 lbs. third, 215 lbs. fourth, 620 lbs. fifth, 3,820 lbs. making in all, 4,731 lbs. of leaves; and that where trees are convenient, two persons will attend and feed 240,000 worms, until ten days from spinning, when five or six active children are necessary.' It is also known, that four or five weeks, where the worms are well fed, completes the time of feeding. The Massachusetts Journal, of 1828, Vol. X. No. 2, page 137, says, 'A single acre planted with the mulberry, will produce from 500 to 600 pounds of raw silk,' but the number of trees is not mentioned.

According to the above calculations, 240,000 worms will consume 6000 pounds of leaves, requiring the time and attention of two women, for five weeks, which, at $3 per week each, including board, is $30; and 6 children, for ten days each, at $2 per week, is $17, making the cost $47 for

6000 pounds of leaves. At that rate, 90,000 pounds of leaves — the produce of one acre — would feed 3,600,000 worms, and cost for feeding them, $705, which being deducted from $1,875, the price of the produce, leaves $1,170 for the annual income of one acre of trees. Thus, by the above calculations, differing but little in the amount, it is seen that the income afforded by one acre, after seven years, must be immense. This acre it is to be presumed, must be of the best quality, and the trees highly cultivated, to produce so much. Mulberry trees will grow on poor land, but the produce will be comparatively small. But supposing Mr Homergue's calculations, to be made from the best kind of land, and that we have much poor, rocky land, let us call the product of leaves only one tenth as much as is estimated above, we have only three pounds of leaves from each tree, and lest it may require more help to feed the worms, we will say four women and twelve children, which will reduce the cocoons to 750 pounds, and the sales to $187 50, and the cost of feeding will be $141, and there will then remain $46 50 for the annual income of one acre.

All the uncertainty in these calculations, arises from the quantity of leaves produced on an acre, and that must vary according to the quality and cultivation of the soil ; all the rest can be ascertained from actual experiment. But I understand it

is the practice of some to let their trees on shares : one fourth of the cocoons to those who gather the leaves, one half to those who tend and feed the worms, and the other fourth to the owner of the trees, which, if the trees produced 90,000 lbs. of leaves, and the cocoons sold for $1,875, would be for one half, $937 50, and one fourth $468 75. But supposing the trees to produce one tenth only of this quantity, then one half would be $93 75, and one fourth $46 87. This amounts to about the same thing as calling the labor of gathering the leaves and feeding the worms, double what it is calculated in the Franklin Journal, at the price of wages and board which I have calculated.

Now taking the smallest estimate of income, and in what way can a farmer remote from a seaport town, acquire so much with so little capital and labor, in about five weeks time ? If any person will point out any way, and prove it, to the satisfaction of the Legislature, or Agricultural Society, I think he would merit a great reward. But this business may be particularly recommended to Overseers of the Poor in every town, who have a farm, — and every town ought to have one — to keep their paupers ; for if one half their paupers are able to gather leaves and feed the worms five weeks, this business would support all of them a year, exclusive of the cost of an overseer. Permit me to suggest

one consideration more, —if all the highways in country towns were ornamented with a row of mulberry trees, on each side, half a rod apart, each mile would contain 1380 trees, the income of which after seven years, would probably pay for repairing all the highways and the expenses of the public schools, if the inhabitants would restrain their cattle and sheep from going at large. There is another method of producing silk from mulberry trees, one year after transplanting them ; which is, to plant them in rows 3 feet by two apart, which would give about 7000 to an acre, and every other year with a sharp instrument to cut them off within three or four inches of the ground and feed them out or cut off every year. But whether this method will produce as much or more silk, than to omit picking the leaves for seven years, I have not obtained information sufficient to decide.

I further remark, that the education of youth is of the utmost importance to the public. May I be permitted to address the inhabitants of every school district, that they would seriously and without delay, consider the importance of connecting the silk business with summer schools, by procuring two or three acres of suitable land near each school house, and have them well covered with mulberry trees and fenced with a mulberry hedge, with sheds near the school house, for feeding the worms and reeling the silk; and having a suitable

mistress and twenty four scholars and over, to be employed in gathering leaves and feeding worms at times not interfering with regular school hours, for the term of four months, the silk worms to be hatched in succession, once in eight or ten days, and the produce of silk will be more than enough to pay the wages and board of the mistress at $20 per month, and the board of the scholars at $1 per week during that time. This can be proved by actual experiment and arithmetical demonstration, if we may believe the testimony of all the silk growers and authors on the silk business.

A shed may be erected near a school house, of the following dimensions, viz. 20 feet long and 16 wide, with nine feet posts boarded with square edged boards, the roof shingled, but no floor, two small windows, one at each end; two frames made like ladders for four tier of shelves, fifteen feet long and four and a half wide, the lower ends of the ladders to be two and a half feet above the ground, and two and a half feet between them; at one end of the shed four more shelves the height of the others, thirteen feet long, one foot and eight inches wide; these twelve shelves will serve for one hundred thousand worms, and will consume about twenty five hundred pounds of leaves previous to their spinning cocoons, after each hatching, and produce two hundred and eight pounds of cocoons and make twenty six pounds of

reeled silk, according to Messrs Homergue's and Cobb's calculations; and by hatching the worms in succession for sixteen weeks, the second hatching in fourteen days after the first, and then in ten days, and then once in eight days, until there are ten hatchings, which at that rate will make two thousand and eighty pounds of cocoons, and two hundred and sixty pounds of reeled silk, which at the lowest price that Mr Cobb has sold his for, $4 50 per pound, amounts to $1170, or selling the cocoons at 40 cents, the price at Philadelphia, they would amount to $832; or say 25 cents, the lowest price offered anywhere, they amount to $520. Then allowing the mistress $20 per month, and the board of the twenty four scholars for sixteen weeks, each at 1$ per week, it amounts to $464, which deducted from $520, there remains $56; which allowing three acres of land and the trees to cost $600, the $56 will pay the interest of the money and $20 left to pay interest for two sheds which will be wanted if the silk is reeled; thus you have the children schooled and boarded without any expense to their parents or the town, and interest on the capital in the bargain. What more do you want, but faith and resolution?

Additional remarks.

I have taken Mr. J. D'Homergue's calculations, and compared them with many others, and then made deductions so great, as to make the produce

of leaves from an acre of trees, when 20 years old to amount to only one third of what he says the same number of trees will produce when 7 years old, and so much, I think, land of a medium quality will produce. An acre of land with 3000 mulberry trees planted upon it, and a shed, will cost $300. At the end of four years, the $300 and interest, will amount to $378 73; two pounds of leaves from each tree, will produce 500 pounds of cocoons, which, at 25 cents per pound, amount to $125. Deducting three fourths for labor, and there remains $31 25 net profit, which being deducted from $378 73, reduces the capital to $347 48.

*5th year* — Capital and interest, $368 32; produce, 2½ lbs. leaves from each tree; value of cocoons, $156 25; net profit $39 06¼; reduced capital, $329 25.

*6th year* — Capital and interest, $349; produce, 3 lbs. of leaves from a tree; value of cocoons, $187 50; net profit, $46 87½; reduced capital, $302 12½.

*7th year* — Capital and interest, $320 25; produce, 3½ lbs.; value of cocoons, $218 75; net profit, $54 68; reduced capital, $265 56.

*8th year* — Capital and interest, $281 19; produce, 4 lbs.; value of cocoons, $250; net profit, $62 50; reduced capital, $218 69.

*9th year* — Capital and interest, $231 81; pro-

duce 4½ lbs.; value of cocoons $281 25; net profit $70 31¼; reduced capital $161 49.

10*th year* — Capital and interest $171 17; produce 5 lbs.; value of cocoons $312 50; net profit $78 12½ reduced capital $93 04½.

11*th year* — Capital and interest $98 62½; produce 5½; lbs. value of cocoons $343 75; net profit $85 93¾; reduced capital $12 68.

12*th year* — Capital and interest $13 44; produce 6 lbs.; value of cocoons $375; net profit $93 75 — which pays the debt of $13 44, and leaves a credit of $80 31.

13*th year* — The above $80 31 hired out on interest, amounts to $85 12; produce 6½ lbs; value of cocoons $406¼; net profit $101 56¼; accumulated capital $186 68.

14*th year* — Accumulated capital and interest $197 S8; produce 7 lbs.; value of cocoons $437 50; net profit $109 37; accumulated capital $307 25.

15*th year* — Accumulated capital and interest $325 68; produce 7½ lbs.; value of cocoons $468 75; net profit $117 18¾; accumulated capital $442 86.

16*th year* — Accumulated capital and interest $469 43; produce 8 lbs.; value of cocoons $500; net profit $125; accumulated capital $594 43.

17*th year* — Accumulated capital and interest $630 09; produce 8½ lbs.; value of cocoons $531

25; net profit $132 81¼; accumulated capital $762 90.

18*th year* — Accumulated capital and interest $808 67; produce 9 lbs.; value of cocoons $562 50; net profit $140 62; accumulated capital $949 29¼.

19*th year* — Accumulated capital and interest $1,006 24; produce 9½ lbs.; value of cocoons $593 75; net profit $148 43¾; accumulated capital $1154 67.

20*th year* — Accumulated capital $1223 95; produce 10 lbs; value of cocoons $625; net profit $156 25; accumulated capital and interest $1463; which remains after paying for the land, trees and shed, together with the labor of gathering the leaves and feeding the worms, and compound interest on the purchase money until paid, and the land and trees at the expiration of twenty years worth more than double the cost, and the trees will probably continue to increase in size 10 years longer.

I think this calculation of the produce cannot be considered exaggerated, for it is not one-eighth as much as Homergue says an acre will produce. Now calculating 10 acres at this rate, and in twenty years you have the establishment clear of debt, and $14,630 in money or, 100 acres, and you have $146,300. And further, these calculations are made on the supposition that the cocoons are sold

before they are reeled; and if a Company should be formed with a sufficient capital for reeling, throwsting and weaving, and manufacturing silk in various ways, the business would undoubtedly be more profitable than raising cocoons, or manufacturing cotton or wool. Let the company have a plantation of mulberry trees of 150 or 200 acres, and carry on all branches of manufacturing silk, they would thereby create a village of industry and wealth, and produce a good market for the necessaries of life, and increase the value of real estate contiguous thereto, besides having stock of their own without buying, and in the end of acquiring immense wealth for themselves, by converting mulberry leaves into silk, and impoverishing no one.

The reader is requested to consider that these calculations are predicated upon an increase of half a pound of leaves a year to a tree after they are transplanted, until they are full grown, and this must be low; for in Mansfield, Conn. it is said full-grown trees produce from 50 to 60 lbs. each. And in these calculations the proprietor does none of the labor, except putting the leaves out on shares; and those who take them make more than common wages at the business. It is an honorable business, for in ancient times virtuous women were clothed with silk. See Proverbs, xxxi. 10, 22.

Now, let a young man of 21 years of age, of steady habits, purchase such an establishment, and mortgage it for security of the payment, and get it insured against fire and other casualties, and put the leaves out on shares, and work himself at some mechanical or agricultural employment, he would at the expiration of twenty years, if a temperate man, undoubtedly acquire double the property which the greater number of professional men attain to, who must have a large sum expended upon them previous to commencing business. Upon the correctness of the foregoing calculations and remarks, every one will judge for himself.

# PART II.

## ON REARING SILK WORMS.

The silk insect affords a display of the wisdom of Divine Providence in the adaptation of means to end, calculated to excite high interest and admiration.

The extraordinary effect produced by this little animal in the short space of six weeks is no less than the conversion of the vegetable substance of the mulberry leaf into threads of rich and durable silk. Well might the Emperor Justinian be astonished to find that the rich and beautiful material of his magnificent robes was first produced and worn by this feeble insect; and well might he repay with munificence the monks by whose exertions the eggs of the silk worm were smuggled in a hollow cane from India to Constantinople. This hollow cane was the ark whence came out the germ of those numerous tribes of this insect which have spread over the whole of Europe, and whose descendants are now fast settling in these United

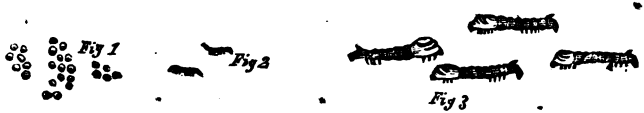
Fig 1
Fig 2
Fig 3


Fig 4


Fig 5

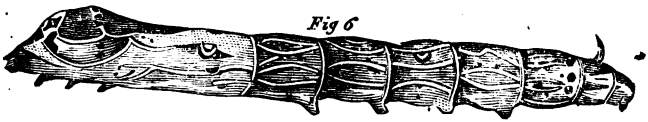
Fig 6


Fig 8

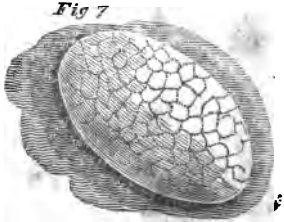
Fig 7

States. Let us commence with the eggs of this insect, and trace its operations, its wants, and various changes, till it forms the cocoon, from which proceeds the moth, which in its turn produces the egg.

THE EGGS.

The eggs are of small size.* When first laid, they are of a pale yellow color, but in three or four days turn to a light slate color, and subsequently to a dull brownish slate color. Those which remain yellow have not been fecundated, and of course are worthless. The most proper place for keeping the eggs until they are wanted for hatching is a dry cellar. They should be kept in a tight box, to protect them from mice or insects, and dry, so that the mold and mildew may not injure them.

It is said that eggs are not injured by being frozen, and my experience on that subject is this. Though I have generally kept my eggs in a tin case in a dry cellar, one season, I accidentally left a quantity in my closet in a chamber, where water froze repeatedly during the winter, and yet those eggs were all hatched in the spring. I also saw some eggs that were laid on the outside of a brick wall under a window, where they were deposited by a stray fly, and exposed all winter, which were

* Vide Figure 1, Plate 1.

hatched in the spring. My experience therefore, would lead me to believe that frost does not hurt them—though I recommend for greater security, to keep them out of the way of it. By putting them into an ice house upon the ice, the hatching may be retarded until they are wanted for successive crops.

### THE HATCHINGS, LEAVES, ETC.

The advance of the season determines the time of hatching the eggs. As soon as the leaf of the mulberry begins to unfold — which is generally in this climate (New England,) the latter part of May — and you observe that there is a prospect of having a sufficient quantity of food, it is time to expose the eggs to hatch. No other process is necessary than to expose them to the air in a room; they hatch voluntarily in a day or two after the exposure. Various modes are adopted in Europe; hatching them in the ovens, carrying them about the person, &c, — but nothing of that kind is necessary here.

It is best to preserve those insects for rearing, that come out as nearly at the same time as possible. It is desirable to have the eggs hatched simultaneously if possible, after the hatching is commenced. Those which come out the same day should be carried along together; and the faster they are brought to maturity the greater will be the

crop. It is said by a Chinese writer, that the period of the changes should be reduced to 23 days, and that if it is prolonged serious detriment to the silk ensues. That the Chinese have ascertained this important fact to be true, that the quantity of silk produced by the worm is less in proportion to the length of time that it remains in the caterpillar form—the longer it remains, the less is the produce, and the rapidity of the reduction is enormous. Supposing that a number of worms, which have been developed in 25 days, have given 25 ounces of silk; if they remain through any want of nourishment or necessary care, in the caterpillar state for 28 days, the amount of silk produced will not be more than 20 ounces; and should they delay to the 30th day, not more than ten ounces will be given; great care, therefore, should be given to hasten the birth and progress of the insect.

As soon as the worms begin to appear,* lay over them young and tender mulberry leaves; they will soon attach themselves to the leaves, and by taking hold of the stems of the leaves, you may remove them easily. They ought now to be supplied with fresh tender leaves three times a day. As the leaves when very young will dry so much in a short time if exposed to the air as to be unfit for use, you may put them in a glazed vessel or

* See Figure 2, Plate 1.

keep them covered in a cellar or cool place; by which means the leaves may be kept good for two or three days.* Besides, it is well to have always in your house at a time, a stock of leaves sufficient at least for three days' provision for your worms in case of wet weather. If leaves are given when wet they will cause disease. Be careful never to pull the leaves when wet, either with rain or dew, except on absolute necessity, and in that case you must spread them and turn them, that the leaves may be perfectly dry before you give them to the worms; rats, mice, spiders, ants and fowls are very destructive to the worms; care must be taken therefore to keep them out of the way of all such enemies.

### THE NURSERY, SHELVES, ETC.

In Europe laboratories have been constructed with great care and expense; but however convenient these may be, they are by no means necessary to success in rearing silk worms; almost any building will answer for that purpose. I have reared them myself with success in a barn, in my

* Mr D'H. proposes the following method to preserve leaves; Put them under cover on a brick pavement, or gravelled floor; turn them over and place them further where it is not damp (for they always leave a dampness where they lie) three or four times a day or an hour before you feed the worms; you may thus keep them three or four days. The leaf wants air to keep fresh.

cellar kitchen, and other rooms of my dwelling-house, and in the lower story of Tremont House in Boston. It was found in France that the cocoons brought to market by the peasants, raised in hovels so full of cracks as easily to be seen through and to admit the air freely, were richer and heavier than those reared in palaces and in the confined rooms of dwellings in cities.* The apparatus of the Rev. Mr Swain, I should think might be worth adopting, for those who are beginning on a small scale; in fact I have had something like it constructed for my own use. This apparatus consists of a wooden frame four feet two inches high, each side; sixteen inches and a half wide, divided into eight partitions by small pieces of wood, which form grooves in which the slides run and are thus easily thrust in or drawn out of the frame.

The upper side is of paper only and designed to receive the worms as soon as hatched; the others

* I saw at Philadelphia on the 21st of June (1831) worms raised by Mr D'Homergue in a yard of mulberry trees, which bore heavy rains and thunder storms, as well as cold windy days, a few of which spun in 30 days and produced excellent cocoons. They began to mount 32 days after hatching. I also saw a few worms raised from eggs which were laid on the outside of a brick wall in a northern exposure, which had stood all the severity of the winter. I saw many thousands of excellent cocoons raised by Mr. Du Ponceau under the care of Mr D'Homergue, in the heart of the city of Philadelphia. I tried some on trees in the open air the present season (1832) but they did not succeed; they obtained however to a considerable size, but the frequent rains destroyed them.

are of wicker work, the opening being about a quarter of an inch square; under each of these are slides. This occupies little space and is neat, and the persons using it can easily remove the litter. I have used three tiers of rough pine boards fixed upon upright posts, about four feet in width, one above the other, with a space between of two and a half feet, affording room sufficient to pass all round the frame, so that I could conveniently reach any part of it. In making the shelves it is well to have the lowest one six inches broader than the one above it, and to make the same difference in the other shelves above, so as to break the fall of such worms as happen to tumble down. A good form for the shelves is that adopted by Mr J. Y. Tomkins, of Baltimore, and which I saw in the nursery of Gideon B. Smith, Esq. of that place. It is about 2½ feet wide, by five or six long, made of thin boards, with a piece two inches wide nailed flat on the upper edge along the sides and ends, with legs about a foot long in the corners. The legs do not pass through the table, but leave a part of the hole on the upper side for the feet of another table to set in. Thus contrived, five or six of these tables are set one above another, and are taken down, cleaned and again set up with facility. One of these shelves will accommodate 500 worms.*

* Farmers, however, who would make it profitable, should raise one or two hundred thousand, and rough boards will make the cheapest and most ready shelves for use on an extensive scale.

It might be as well to put old newspapers on the shelves, which might be taken off whenever it was necessary to clean the worms, and then replaced. Thus I have done.

### THE DIFFERENT AGES, MOULTING, ETC.

There are several varieties of silk worms.* The most common varieties change their skins four different times. These changes are called moultings, and the intervening times the different ages. The time requisite for the several changes depend greatly on the temperature. If the weather is warm, they will generally happen as follows; the first moulting on the fourth or fifth day after the hatching; the second begins on the eighth day; the third on the thirteenth and fourteenth days, and the last change on the twenty second.

The fifth age lasts about ten days; at the end of which the worms have reached their ultimate growth, being three inches in length,† and are prepared to spin their cocoons. Thus thirtytwo days intervene between the hatching and the beginning of the cocoon, and I have known the period retarded to sixty days. These changes will only be noticed by accurate observers.

* I saw in the Nursery of Gideon B. Smith, Esq. of Baltimore, four different varieties. I would recommend, as most profitable for rearing, the large white.

† See figures 2, 3, 4, 5, or the different appearance of the insect in its different stages.

Too many leaves should not be given to them at once, and the leaves given should be spread very thin, because if put on too thick, a great number of the worms when small will run the risk of being lost and carried out among the litter. When the worms are in the first age, you need only clean the litter once or twice, as you find it necessary. During the whole of the first age, the leaves of the young plants of the mulberry, as being the tenderest, are preferable to the leaves of older trees for the food of the young worms. It is well therefore to sow some mulberry seed every year so as to have a succession of young plants. During the temporary sickness produced by the changing of the skin they should be fed with a very sparing hand. The sign, by which it is known that worms are sick and about to change their skins, are these; they hold their heads up, are motionless and appear to sleep; — this should be noticed.

During the second age it is advisable still to continue to feed your worms with leaves from the young plants, as they are still preferable for them. You must now begin to be attentive to clear away the litter from time to time, so as to prevent all danger from its heating, which proves highly injurious, though some people never clear away the litter at all. These insects are remarkably fond of

cleanliness, which besides helps to enliven them and gives them a keen appetite for the leaves that are given them. The litter is taken away in the following manner; you scatter some fresh leaves upon one corner of the shelf, to which the worms having attached themselves, which they will readily do, you then take up the worms by means of the leaves and stalks they cling to, leaving the litter underneath. Having thus taken up all the worms from that corner and placed them in a clean place, you then clear away the litter from that corner and carefully sweep together with a little broom or wing, all the dirt, which you remove entirely: you then remove the worms next adjoining to the clean place thus prepared and put them into it; in this manner you proceed with the rest.*

During the third age the full grown leaves of the largest trees may be given — though it would be well to reserve the largest and toughest leaves till the last age, when they are the most voracious. During the third age, the litter should be removed at least three or four times; worms that die or appear to be diseased should be immediately removed.

The same treatment will be required during the fourth and fifth ages as in the preceding. As they

* If the worms are laid on a newspaper, it is easy to take out the newspaper, lay it on a table, and transport the worms, who generally adhere to the leaves and branches, to another newspaper, which is put on the shelf after sweeping it. The litter on the other one may then be thrown away.

advance in age the greater will be the proportion of food required and the oftener the litter must be removed; by these means the process is sooner brought to a conclusion, and the worms always kept in high health and appetite. During the four or five days previous to their rising, the worms consume an incredible quantity of leaves, eating with great voracity, and at this time the labor of tending them is most fatiguing. You will know when the worms are ripe or ready to rise and form their cocoons by observing them with attention when you give fresh leaves. Those that are ripe, instead of eating, avoid the fresh leaves, and run over them as fast as they can wander about, and try to climb; they will look transparent, of the color of a green gage plum, and somewhat diminished in size.

In the fifth age the worms should have new leaves as often as the old ones are consumed, until they are observed to creep on the leaves without eating. At night they should have a double portion.*

* Dr. Pascalis of New York, a gentleman of great literary reputation and highly scientific attainments, has by the use of Electricity been enabled to hasten the progress of silk insects; and worms reared by him, to which this powerful agent was applied, have spun their cocoons in 27 days from the time they were hatched. I have never made any experiments in this way myself, but doubt not that this, as well as many other improvements will be introduced. The same gentleman has also

PREPARATIONS FOR THE COCOONS.

Previous to the rising of the worms, some little arches or cabins should have been prepared of brushwood or broom corn, by setting their branches with their top spread, pressing against the bottom of the upper shelf to hold them in their position. The worms will readily find and climb these little trees and spin their cocoons in them; the worms will be three or four days spinning their cocoons,† and they will all generally be finished in eight days. The brush may then be taken down, the cocoons taken off, cleared of the loose tow and prepared for reeling. I have found that the branches of the oak, with the leaves on, answered the purpose for these arches very well, as the leaves are strong and do not crumble in taking off the silk. They should be cut some days before hand, and be dry when used. Some prefer to have the brushwood, entirely stripped of its leaves. Mr. Smith, of Baltimore, uses and recommends the broom corn.

recommended in his valuable work, the Silk Culturist, (No. 2, page 105,) artificial mounting slides, upon which the worms may mount and spin their cocoons. Those who have curiosity to see these improvements, will find a drawing of them in the work referred to.

† See the Cocoon, Fig. 7, Plate 1.

SEED COCOONS.

Those cocoons that are intended for seed may be stripped of their tow and strung upon a thread — care being taken not to pierce entirely through the cocoons — and hung up until such time as the moths come out,* which will be in one or two weeks, when the males and females will couple ; they may be taken by the wings in pairs without separating them and placed on large sheets of paper, (old newspapers will do,) where they are to remain ; as many pairs of moths as can conveniently lie on the papers may be placed there. The room in which these are placed should be secure from mice and ants, and the sun should not be permitted to shine on them in any stage of their existence ; as soon as the moths on one sheet have done laying their eggs, it should be folded up and put down cellar, or in some cool dry place until wanted for use the next spring.

The moths (see fig.) are in the form of a grayish white butterfly and generally begin to lay their eggs in 24 to 36 hours, after leaving the cocoon. Each female moth will lay from three to four hundred eggs, generally handsomely disposed and firmly attached to the paper in a circular form.

Should the eggs be permitted to remain exposed to the warm weather, they will sometimes hatch the

* See the Fly, Figure 8 Plate 1.

same season, and unless another crop be desired, they will be lost. The moths eat nothing after leaving the cocoons, and die in a few days after depositing the eggs.

### DISEASES OF SILK WORMS.

The foreign writers enumerate and describe a variety of diseases to which silk worms are liable in their different ages, and particularly in the fifth, which all agree to be the most critical. But to all these diseases they prescribe the same means of of prevention and the same remedies when they have occurred. It is therefore unnecessary to describe their various symptoms, as it would lead to no good practical result.

The diseases of silk worms generally arise from the want of sufficient air and space, from their not being kept dry, and being fed with damp leaves, and also from their not being kept sufficiently clean, particularly in the fifth age. The fermentation of their litter, the dampness and the bad air which it occasions, are the most frequent causes of mortality among them. The greatest care therefore should be taken to keep them constantly clean and dry, and to give them a sufficient quantity of space and air ; a current of air in fine warm days, should always be let into their nursery. If, notwithstanding all the care taken, some general sickness should declare itself among them,

the remedy recommended by the writers, is, to give them a change of air, by transporting them into another room. But this may not always be convenient. It is with these animals, as with our species, easier to prevent diseases than to cure them. If nothing better can be done, the diseased worms must be thrown away. The chloride of lime and soda have been used with good effect in some nurseries to cleanse the air.

Before the worms begin to mount and spin their cocoons, they void themselves of their excrements, and they generally do it on or near the edge of the board on which they are placed. Those who have not strength enough to cast off their excrements, die in the attempt, and in the morning numbers of them are found dead. They should be carefully taken up and thrown away. When many are found in that condition, it is a sign that the litter is fermenting and that a cleaning is necessary.

It is possible that there may be diseases of the silk worms peculiar to the climate. Experience will enlighten us on the subject. I have heard that ladies in one of our Southern States have lost all their worms this year, from the *plague getting in among them.* It is certain that there are epidemic disorders by which whole nurseries of silk worms are sometimes destroyed. But these are of rare occurrence in our country; and it is hoped that they may be prevented by careful attention to the ules prescribed.

CURING THE COCOONS.

Were it possible to wind off all the cocoons before the insect naturally pierces them, it would be best to do it, because the silk at that time winds off with greater ease than afterwards. But as this is sometimes impossible and often inconvenient, various methods have been devised to stifle the chrysales in the cocoons. This may be done by placing them in an oven, moderately heated, or in the steam of boiling water; even the sun is sufficient for this purpose in southern latitudes, by acting upon them several days. I have used the first method with success. The oven being moderately heated, the cocoons were spread out, in oblong baskets eight inches deep, in box covers, pans, &c., and permitted to remain in the oven half an hour. In being cured they loose about twenty five per cent. in weight. Mr Smith of Baltimore, says he has found the following method preferable to any other, and that the object is perfected without danger of injuring the silk. I put the cocoons, says he, into a tight tin vessel, with a cover closely fitted, and put this vessel into another a little larger, containing such quantity of water as will nearly fill it, when the other is put into it.

Fire is then applied, and the water kept boiling, half an hour or more according to the size of the vessel, and until the cocoons in the inner vessel

shall have become as hot as the boiling water. The cocoons are then spread out in a dry room, that the moisture may evaporate. After this operation, the cocoons are ready for the reel or for sale.*

### SPACE REQUIRED FOR SILK WORMS.

It is calculated that the worms proceeding from one ounce of eggs, which in numbers are estimated at 35 to 40,000, should have a space on the shelves,

| | squ. ft. | in. |
|---|---|---|
| In the 1st age of | 7 | 4 |
| In the 2d age of | 14 | 8 |
| In the 3d age of | 34 | 10 |
| In the 4th age of | 82 | 6 |
| In the 5th age of | 183 | 4 |

As a general rule they ought not to touch one another.

### QUANTITIES OF SILK YIELDED BY VARIOUS PARCELS OF COCOONS.

Eight pounds of cocoons (16 ozs. to the pound,) produced from 16 to 18 ounces of silk, 6 to 9 cocoons to the thread. Mrs Williams obtained nearly one ounce and a half, from 244 cocoons.

Miss Rhodes had on an average one ounce from 244 cocoons.

* This might do, perhaps, for a small quantity of cocoons, but I think for a large one, it would cost too much, and give too much trouble.

The estimates of the number of worms to make a pound of spun silk are various.

Mr. Storrs of Conn. says 4000; Mr Tufts of Dudley says 3000; Mr D'Homergue says 2400, of 350 to a pound, the moth not stifled.

I should say the last estimate was the most correct, and even a less number will produce a pound if they are well taken care of. I have had three pounds from 8000 in one season including floss.

### WEIGHT OF COCOONS.

Two hundred cocoons, from worms raised in the early settlement of Georgia, weighed a pound. In Pennsylvania, 306 cocoons from worms fed by the late Mr Busti, and from 490 to 600 in the establishment of Mr Terboven, weighed a pound.*

It is very evident that there is great difference in the weight as well as the quality of cocoons; and

* Mr Pintard of Philadelphia, has raised Silk Worms from eggs produced on Messrs Terhoven's farm, 335 of the cocoons of those worms, chrysales not killed, weighed one pound. Mr D'Homergue aided him in counting and weighing them.

Of the cocoons raised in Philadelphia by Mr D'Homergue the present year, which I saw, the eggs were partly from South Carolina and partly from France; the former were large and were found when weighed, to contain 337 to a pound. The French cocoons were small, and 387 weighed one pound. The chrysales not stifled and the cocoons just gathered.

Of cocoons raised in Massachusetts, by Mrs Davenport of Milton, from eggs furnished by me, and tended agreeably to my instruction, 206 weighed one pound, before the chrysales were killed, and 407 weighed two pounds.

the quantity required to make a pound of reeled silk. This may depend upon the different variety of the worms or the greater or less care in nursing them.

The following calculation of the labor attending and connected with the culture of silk, is by John Fitch, Esq. of Mansfield, Conn. and is taken from the manual published by order of Congress. One acre of full grown mulberry trees, set one and a half rods apart, will produce 40 pounds of silk.

The labor may be estimated as follows :

For the three first weeks after the worms are hatched one woman who is acquainted with the business, or children who would be equal to such a person.

For the next twelve or fourteen days, five hands or what would be equal to five if performed by children. In this period two men with other help would be employed to better advantage than all women and children. This period finishes with the worms. For picking of the balls and reeling the silk, it will require about the same amount of labor for the same length of time as the last mentioned period, which may all be performed by women and children. The aforesaid labor and board may be estimated at eighty dollars ; spinning the silk at thirty four dollars ; forty pounds of silk at the lowest cash price, is worth two hundred dollars ; which makes the following results.

| | | |
|---|---|---|
| 40 pounds silk at $5 per pound . . | | $200,00 |
| Labor and board . . . | 80,00 | |
| Spinning . . . . | 34,00 | |
| | | 114,00 |
| Net profit per acre | | $86,00 |

The principal part of the labor may be performed by women and children. But when the business is carried on to a considerable extent, it is considered more profitable to employ some men for the last period of the worms.

COST OF RAISING SILK BY MR D'HOMERGUE.

Four ounces of eggs, each ounce containing about 35,000 eggs, making in all, 140,000 eggs.

If the mulberry trees are on the farm where the eggs are raised, two women are sufficient to gather the leaves, until the fourth moulting. The worms should be fed three times a day, and cleaned once after each moulting.

In the last ten days additional help is necessary, as the worms require more frequent cleaning, in consequence of the greater quantity of leaves which they consume ; and to prevent fermentation, and consequent sickness, more attention is required at this time.

Mr Du Ponceau has raised seven ounces of eggs with only the labor of two persons, and these not employed the whole of each day, except on the last ten days, and some occasional help, who were

# PART III.

## REELING AND MANUFACTURING SILK.

Those who do not choose to proceed any farther in the business than to raise the cocoons, may realize a reward for their industry, by selling the silk in that shape. There will probably be regular advertisements in the papers, offering cash for cocoons; and there is no doubt but that there will soon be established throughout the United States a regular market price for the article.

But as raw silk is the shape in which the article must be sent to foreign manufacturers, if exported, and in which it meets with a cash market in almost every part of Europe, and in many parts of our own country; it becomes of great importance that we should reel the cocoons, at least, and that in the most economical and profitable manner. The art of reeling was formerly carried on to considerable extent in Georgia, and large quantities of raw silk were exported. It has been carried on in Connecticut for seventy years, in a way which will be

mentioned hereafter. Dr Franklin addressed a letter on the subject to Dr Cadwallader Evans, from London, January 15, 1770. The Philosophical Society of Pennsylvania, to whom he sent the work of the Abbe Sauvage, a summary of which has been published by Mr Odell, of Burlington, resolved to petition the Legislature for the encouragement of this new branch of industry, and proposed to raise a fund by subscription, for the purchase of cocoons and a filature. Eight hundred and seventyfive pounds were obtained the first year among the citizens, and this money was laid out for the purpose. But unfortunately the war of the Revolution put a stop to the scheme. Lately, however, Peter S. Du Ponceau, Esq., of Philadelphia, the friend and companion in arms of Lafayette, has made successful exertions in this department. He has associated to his labors Monsieur J. D'Homergue, who is a native of Nismes in France, and was educated in that country in an extensive manufactory of silk, and is familiar with all the processes used in that country. These gentlemen have published a valuable series of essays on the subject of silk culture, the impulse of which has been felt throughout the Union, and their publication has, on the whole, thrown great light on the general subject. And although the establishment of a national school of filature as contemplated by these gentlemen, has not yet re-

ceived the patronage of the government, there is strong reason to believe that something will be done to aid this business by Congress at a future session. Mr Du Ponceau sent me some of the silk reeled by Mr D'Homergue the last year, which was of excellent quality. I had it throwsted and returned to him. In a late letter to me Mr Du Ponceau stated that he had been honored with letters from all parts of the continent from Maine to Louisiana, requesting information on this subject. That the impulse given by the operations of Congress had been felt even in Europe; that he had caused one hundred copies of the Report of the Committee on Agriculture of the House of Representatives of the United States, to be printed in English, and one hundred in French, to be disseminated throughout Europe. The result had been that numbers of silk manufacturers, throwsters, dyers, and weavers, had come to this country from England, France, and Germany, having heard at home that the silk business was encouraged here; but they have found no work for want of raw silk, and were obliged to turn to the cotton manufactories for employment. That no reelers were among them. Mr D. had about sixty pounds of raw silk reeled at his filature, which he has sent to different markets to try the prices.*

*Since writing the above I have visited the city of Philadelphia, and was politelly favored by Mr Du Ponceau, with liberty

Mr D'Homergue divides the raw silk into three qualities, graduated according to their different degrees of fineness. These different qualities, before they undergo the operations that are to fit them for the loom, are distinguished as first, second, and third qualities, beginning with the finest. They assume other names as soon as they have been prepared and made fit for the manufacturer. Then they have ceased to be raw silk, and they are called singles, organzine, and tram silks, according to their different degress of fineness, and the manner in which they have been passed through a certain machine called a mill.

to make several visits to his nursery and filature. The filature was established by Mr Du Ponceau under the direction of Mr D'Homergue, in which ten reels have been employed, each of which is worked by two women under the superintendence of Mr D'Homergue. This filature is not in a room, but under a shed entirely open on one side, with hangings from the roof on the other, which may be opened when required to promote a free circulation of air. The reels of this filature are made chiefly on the model of the Piedmontese reel, (vide plate) somewhat simplified by Mr D'Homergue. Mr D'Homergue put one of these reels in operation in my presence, and it appeared to work very easily. The silk reeled by Mr D'Homergue, at that time, I have preserved as a specimen, and have since been informed by an intelligent merchant of New York, that it would bring seven dollars a pound in France. I was also shown several parcels of sewing silk, manufactured by Mr D'Homergue, from the refuse cocoons. I take this opportunity to acknowledge the fairness and liberality of these gentlemen in introducing me to every department of the silk business, and for the polite attentions I received from them during a visit of two or three days to their city.—Ed.

Singles (called in French *le poil*) that is to say, hair silk, is made of the first quality of raw silk, consequently the finest, as the name implies. It is made of a single thread. The silk is used for the woof of the lighter stuffs, the warp which is made of cotton thread.

Organzine (in French *organsins*) is the next in fineness. It is employed in weaving to make the warp of those stuffs, that are made entirely of silk.

Tram silk (in French *La trame*) which means woof silk, is thickest of the three, and is the thread of which is made the woof of silk stuffs.

Of the three qualities of raw silk of which these different threads are made, the second, that which makes organzine, is the most in demand in foreign markets. It was in extracting the silk to form this quality that Mr D'Homergue discovered the superior fineness of the American silk, by finding that it required a much greater quantity of threads to produce the different qualities of raw silk abovementioned than the cocoons of Europe.

In regard to the imperfect cocoons, Mr D'Homergue makes use of the excellent paragraph from scripture, 'gather up the fragments that nothing remain.' He says there are a great variety of those, whose threads are not susceptible of being prepared for the manufacture of silk stuffs. They are called in French *chiques*. The material extracted from these cocoons is employed in the

manufacture of sewing silk. This silk is of two kinds, each of which has its first and second quality. The name of sewing silk is exclusively appropriated to the finest of these two species, the other is called cordonnet or twist.

The sewing silk, so called, is employed in the sewing of silk stuffs, the cordonnet is used for working button-holes, and working woollen and cotton stuffs. The one is for the use of tailors, the other for milliners and mantua-makers. Tailors employ it only in the more delicate works. The raw silk for these purposes is extracted from the bad cocoons, reeled and wound into skeins, according to its different degrees of fineness, in the same manner and by the same process (varying only in details) as that intended to be used for the manufacture of fine stuffs. It is sold in market under the name of raw silk, but does not bear so high a price as the other.

There is a loose, furzy substance on the outside of the cocoons, which is neither fit for use in the silk manufactory, nor for sewing silk. This is commonly called floss. To this are added all which either from some defect in the cocoons or from the awkwardness of the reeler, either break or come out uneven, or are otherwise unfit for use, and which are called waste silk. This mass boiled in soap and water, and afterwards carded,

and spun on the spinning wheel, makes excellent yarn for stockings.

Mr D'Homergue classes the different kinds of silk extracted from the cocoons into six different kinds, viz.

1st, Silk of the first quality or singles.
2d, Silk of the second quality or organzine.
3d, Silk of the third quality or tram silk.
4th, Sewing Silk of the first and second quality.
5th, Cordonnet or twist Silk of the first and second quality.
6th, Floss Silk.

The whole of the labor of extracting these different silks from the cocoons, and all the preparatory work until it is put to the mill is done in France by women, who have separate tasks assigned to them in each of the various complicated branches of this business; the workshops are superintended by an overseer who is master of the whole business.

Mr Murray, a European writer, says that he visited an establishment for unwinding the silk at Buffalora, on the Milanese frontier. Women were arranged opposite each other and conducted the process; the cocoons contained in baskets on one side, were thrown by handfuls into cauldrons of water, kept boiling by charcoal fires beneath. Each (by a whisk of peeled birch) collected the threads en masse; the first confused portions were reject-

ed till the threads unwound regularly, freely passing over the glass rods to prevent the injuries of friction. The first portions, necessarily useless, are separated by the hand. When the thread came off uniformly, the cocoons were raised, suspended to the hand by their respective threads, and thus handed over to those on the opposite side, who in their turn threw them into cauldrons of water, the temperature of which was nearly that of blood heat and more than milk warm, thus sustained by a steam pipe. The water was thus kept clean and the silk preserved pure and unsoiled; from these the threads were finally wound. The proprietor informed him that this establishment cost about 60,000 francs, or about twelve thousand dollars.

This was probably Gensoul's apparatus, on which great encomiums have been passed. In this apparatus the water is heated by steam; but it is expensive and has not yet got into general use even in Europe.

We in America are not obliged to pursue the same course that is followed in Europe. The ingenuity and intelligence of our community will soon arrange a reeling apparatus by the family fireside; and that part of the year which cannot be employed in rearing the worms will be advantageously improved in reeling the cocoons to any given pattern or degree of fineness; nor is there

in fact any more difficulty in it than in the manufacture of straw, and many other employments which have engaged the attention of our females. The time is not probably far distant, when America will excel Europe in her silk manufactures as much as she now does in her cotton.

The great requisite in reeling is evenness and equality in the threads. After the cocoons by reeling have been converted into *raw silk*, that silk, before it can be used in the manufactory of fine stuffs, must undergo the operation of *throwsting*, that is to say *twisting*, which is done by means of a machine called a *throwing* or *throwsting mill*, and the mechanics who perform that work are called *silk throwsters*. There are several of them already in the United States, chiefly from England, but they have as yet been mostly employed in throwsting foreign silk, imported chiefly from China.* The operation of throwsting is the test of the good or bad reeling of raw silk. If it be entangled, or not sufficiently freed from its gum, the threads break in the preparatory operation of winding, and that occasions much loss. If the threads are not equal, that is to say, if there is not in each thread as nearly as possible the same number of fibres, as the twisting is done by machinery which works by an equal regular motion, the force which will only twist the

* I have three of them in my employ.

strong parts of the thread will break the weak ones, and that with the loss by winding, produces what is called waste. In proportion to the greater or less quantity of waste that is found in raw silk is the price or value in foreign markets.

Mr Du Ponceau has communicated to me a letter which he has received from an eminent silk merchant in Paris, in which he tells him that the best French raw silks of 15 to 20 fibres, lose only by waste 1 to 2 per cent.; those of Asiatic Turkey, from 6 to 8; those of Calabria, 8 to 12; those of Valencia in Spain, 6 to 8; those of Syria, 15 to 20; and those of Saloniki and the Morea, he says, are still worse. That gentleman requires two years for the American women to learn to reel silk in perfection; but there is no doubt that they will learn in a much shorter time. The silk reeled last year at Philadelphia, by women, under the direction of Mr D'Homergue, was pronounced in England to be a fair beginning. At the last news received from that country, it had not yet been thrown, except a small sample at Manchester, which was said to have undergone every test, and produced a result highly satisfactory. In quality it was said to be superior to most Bengal silk, and equal to the silks of Friuli and Trent.

Mr Richard Radnell, a late English writer, in his view of the English silk trade, published at London in 1828, states the average waste in differ-

ent silks to be as follows: — French silks, 4 to 10 per cent.; Lombardy silks, 4 to 12 per cent.; Friuli silk, 4 to 15 per cent. So that it would seem that French silk is better reeled than Italian silk, which is different from the opinion before generally entertained. On silk from Persia, the waste is estimated from 8 to 20 per cent.; and on Brutia silk, from 4 to 18.

As to Bengal silk, that which is reeled in the company's filatures, which is distinguished by the name of Novi silk, because it is reeled under the direction of an Italian, from Novi, in Piedmont, is estimated to lose by waste from 4 to 8 per cent., which would make it superior to French silk; while that reeled in the native filatures as they are called, is estimated to lose from 5 to 15 per cent. See Radnell's View, p. 34.

The reeling of silk from the cocoons requires skill, practice and experience. But let not those who undertake it be easily discouraged; perseverance and attention for a short season will enable them to become expert at the business, although their first efforts may seem discouraging.

The following instructions for reeling silk, I have found from practical experience of several years in my own family, to be useful. They are chiefly extracted from the manual published by authority of Congress.

The reeling may be done at any season, but

best in dry weather; it may be carried on in the dwelling-house or in a shed, or other convenient out-buildings.

The softest water should be chosen for soaking the cocoons. The proper temperature cannot be ascertained until the reeling is commenced, owing to the different composition of the silk. It is as well to raise it to near the boiling point, and then, if necessary to lower it, cold water may be added. The soft or satiny cocoons require water less heated than the others. If too hot water be used they furze out in unwinding. The dupions or double cocoons require the hottest water. The fire under the basin may be lessened or increased, as the occasion may require; a little attention will soon enable the person who has the management of the basin to preserve the water at the proper degree of heat. The reeling is effected by use of a silk reel, (vide plate) and a basin of water set over a moderate fire in a small furnace. The person charged with the management of the cocoons in the basin must be provided with a small whisk of broom corn, or sharp twigs, cut sharp at the points; and being seated behind the basin, previously filled with hot soft water, and placed upon a furnace, containing burning charcoal, she must throw into the water a handful of the cocoons, and press them gently under the water for two or three minutes, in order to soften the gum of the silk, and thereby

to loosen the ends of the filaments. She is then to stir the cocoons with the end of the whisk as lightly as possible, until one or more of the fibres or filaments adhere to it; when, disengaging it, and laying aside the whisk, she is to draw the filament towards her, until it come off quite clean from the floss which always surrounds the cocoon, and the fine silk begins to appear; then breaking off the thread, and collecting the floss first taken off, she must put it aside; the whisk is then to be applied again to get hold of the firm fibres, and again, until a sufficient number are procured to form the thread of silk required to be wound off. This done, she is to unite a number of the fibres, according to the fineness of the intended thread, and deliver the compound thread to the reeler, who puts it through the guides; another thread is in like manner to be prepared and passed through the other guides, when two skeins are to be wound, and they may be crossed; the threads are then raised forward and made fast to one of the arms of it. Both threads being fastened to the reel, it is to be turned with a regular, even motion, at first slowly, until the threads are found to run freely and easily; for it will happen that some of the ends which were taken to compose the thread were false; because on taking off the floss there may be two or three breaches made in the beginning of the fibres, which, in winding, will soon

end, and must be added anew to make up the number designed for the thread.

It is proper, therefore, in the beginning of the thread, to put a few more cocoons than it is intended to continue, as they will soon be reduced to the proper number. The crossing of the threads is considered as an improvement, though it is sometimes reeled without crossing.

As soon as the pods begin to give the threads freely, the reel is turned with a quicker motion. If the pods leap up often to the guide, the reel must be slackened, and the spinner may let the thread pass between the thumb and finger before it reaches the guide. If the thread comes off in burrs, it must be turned quicker. The fire may at any time be increased or diminished, as found necessary, that the reel may be allowed a proper motion, which ought to be as quick as possible without endangering the breaking of the thread, or hurrying the spinner, so that she cannot add fresh cocoons, as fast as the old ones are ended. The quicker the motion of the wheel is, the better the silks winds off and the better the end joins to the thread. One might imagine that the rapidity of the motion might overstrain and break the thread; but from constant experience it has been found that the thread never breaks from the rapidity of the motion; but on the contrary, the quicker the motion is, the more advantageous it is for winding the silk.

While the reel is turning, the spinner must continually add fresh fibres to each thread as fast as she can find the ends, not waiting till some of the number she began with are ended, because the internal fibres are much thinner than those constituting the external layers, but must constantly prepare fresh ends by dipping the whisk among fresh cocoons, of which such a quantity must be occasionally thrown into the basin as will suffice to supply the threads which are reeling, but not more.

The cocoons thrown in must be often forced under water that they may be equally soaked, for as they swim with their greater part above water, that part would remain hard and stubborn, while the part which is under water would be too much soaked; some hot water may be thrown upon them frequently with a brush, and also on the cocoons which are reeling, when they grow dry at the top and yield the fibres with difficulty. The supplying fresh ends when the cocoons are exhausted, or diminished, or the fibres break, is performed by taking one end of a fibre and throwing it lightly on the one that is winding, and rolling them between the thumb and finger, or gently pressing them.

As often, therefore, as the cocoons, partially wound, are exhausted, or the fibres break, fresh ones must be joined to keep up the number re-

quisite or the proportion; thus three new ones may be wound and two half wound, or four new ones, and the silk will then be a thread of four to five cocoons. The adroitness in adding fresh ends can only be acquired by practice. The difficulty of keeping the thread even is so great, owing to the increased fineness of the fibre inside, that we do not say a silk of three or of four or of six cocoons, but a silk of three to four, of four to five, and of six to seven.

In coarser silk we do not calculate so nicely as one cocoon more or less, we say for example from twelve to fifteen, from fifteen to twenty cocoons. In beginning a thread of ten cocoons, from sixteen to twenty will sometimes be required to preserve a uniform thread, after a portion of the first layer has been wound off. The quantity of silk which can be reeled in any given time, is in proportion to the quickness with which the spinner can add fresh cocoons. Thus, if we suppose that every cocoon at a medium, will either break or be wound off at the end of every five hundred feet, then, if five such pods are reeled together, one will be wanted to every hundred feet that are reeled; if ten are reeled together, one will be wanted at every fifty feet; if sixteen together, then at thirty one feet, and so on. The seldomer cocoons end, or break, the greater number of them can one spinner attend, which shows the advantage of sound cocoons and of expert management in reeling.

The cocoons which wind off in part only and the shells must not be permitted to remain in the water, as they will obscure and thicken the water, and injure the color and lustre of the silk, which can then be used only for dark colors. The shells should be buried to prevent their being offensive; as a general rule, the water should be changed as soon as it becomes discolored.

When the spent cocoons leap up and adhere to the guide wires, they must be immediately taken away, else by choking the passage they will endanger the breaking of the thread.

When the reel has remained any time idle, the thread between the basin and the wires may be wet, to cause the thread to run easily.

In winding off the best cocoons some defective ones will be found among them, which will not wind off or are full of knobs; these should be taken out of the basin immediately in order to be wound by themselves.

The breaking of the fibres is principally owing either to bad cocoons, viz. being ill formed, (as they will be when the worms were disturbed and interrupted during their spinning,) or the fibres may break by improper regulation of the heat in the water; first, when it is not sufficient to make the silk come off easy, or second, when it is too great and occasions burrs, which may stop at the holes through which the thread runs; cocoons also which

have two worms inclosed will perpetually break; the whole thread may also break, by burrs stopping at the holes of the guides, or by the reel being turned by jerks. It may be fastened like the fibres, by laying the parts on one another, and giving them a little twist.

A sharp fork may be conveniently made use of to draw away the spent cocoons, or such as being nearly spent, stick at the holes in the guides; and as the whisk will frequently take up more ends than are immediately to be added, and as the spinner will sometimes have occasion to employ both her hands, the brush may at that time be conveniently hung up by the basin, while the cocoons which are attached to it remain in the water, and the ends will be in readiness as they are wanted. If the spinner be under the necessity of leaving off work for any length of time, the cocoons should all be raised with a skimming dish out of the water till her return, otherwise by oversoaking they would wind off in burrs; but it is best to continue the reeling without interruption, and to let fresh, but equally experienced persons, succeed those who are tired. The person who turns the wheel should have an eye to the thread and to the guide wires through which they pass, that he may apprise the spinner when anything is wrong; for her eyes will be sufficiently employed about the cocoons. The reeler may also rectify anything

discovered to be amiss in those parts of the thread which are near the reel, for one hand will always be employed, and a stop must occasionally take place.

As the heat of the water in the basin will require to be varied according to the ease or difficulty with which the different sorts of cocoons give off their silk, the spinner should always have some cold water within reach, in order to cool that in the basin quickly, when the silk comes off too easily and in burrs. The water is also necessary for the woman managing the cocoons, to cool her fingers.

More fuel should also be at hand to increase the heat quickly, when the cocoons do not give off their silk readily.

If there should happen to be any sand in the water, the heat causes it to rise to the surface and fix on the cocoons, the thread of which will break as if cut; for this reason the utmost care must be taken to guard against it and to remove it. Previously to being boiled, the water should be permitted to settle, and the pan must be carefully wiped. If necessary, the basin may be covered while the water is heating.

When the cocoons are first put in water, if the silk rises thick upon the brush or comes in lumps, it is a sign that the water is too hot; if the thread cannot be caught, the water is too cold; when the cocoons are in play, if they rise often to the guide

wires, the water is too hot; if the cocoons do not follow the threads it is too cold. It will be seen by observing the position of the thread upon the reel, that the different layers do not lie parallel to, nor upon, but cross one another. This is owing to the mechanism of the apparatus, and if particularly contrived to effect this object, which is essential to the perfection of the process, and one to which the acknowledged superiority of the Italian silk is to be ascribed. It is effected by the see-saw motion of the distributing rod, which depends upon the relative proportion between the axle and pulley; without this crossing, the threads, from their gummy nature, would inevitably adhere and render the subsequent windings and twistings of the silk very difficult; this sticking together of the silk is called glazing. But the mechanism above mentioned of the distributing rod, prevents the threads lying over each other upon the reel until after it has made many revolutions, and the former threads have dried. During this time the exposure of the threads to the air, causes the first layer to completely dry, and hence no adhesion between them can take place.

The effect of the irregularity of the movement caused by the distributing rod is also to imitate in the unravelling of the cocoon, the same method employed by the silk caterpillar in forming it; for it is a fact that the silk fibres of the cocoon are spun on it in zigzags, like those formed by the silk reel,

and consequently the operation of the reel is an imitation of nature, of which the industry of the caterpillar instructed by her is the prototype. Mr Nouaille says, that a woman at Novi, (Italy,) experienced in the business with the assistance of a girl to turn the reel and attend to the fire under the cauldron, can with ease reel off one pound of silk consisting of four or five cocoons of the most perfect quality in a day. I am credibly informed that the price of silk reeled according to the above directions, in Europe, is from four to seven dollars, according to its fineness. Mr D'Homergue says a woman may now reel three pounds in a day. Mr Brown thought he could reel a pound in a day upon my improved reel, but I have never been able to have the finer qualities of silk reeled so rapidly in my family. The silk reeled upon my reel* sells for 4,50 per pound as it comes from the reel, and some at a higher price. My reel is similar to the Piedmontese, with some considerable improvements, it is finished in a much neater style than any I have seen in this country; it is portable and will be furnished to any who may apply, for the sum of ten dollars.

In preparing the dupions or double cocoons for winding, more are put into the basin at once than

* The fringe of the curtains in the house of Hon. Daniel Webster of Boston, was made by Mr Brown from silk raised by me and reeled in my filature.—Ed.

of the finest kind. They must be first well cleaned from the floss outside ; the water also must be boiling hot, and as the silk they yield is of a coarser quality than the other, and has a good deal of floss upon it, the person who turns the reel must take the opportunity, while the one who manages the basin is preparing the cocoons for winding, to clean and pick off the loose silk from that which is on the reel. These make a coarser thread of fifteen to twenty cocoons ; and perhaps as coarse as from forty to fifty cocoons ; it is useful for filling in coarser stuffs and likewise for sewing silk.

The satiny cocoons require water only moderately heated. The proper heat will be found by observing the manner in which the silk comes off from the first of them which are put in a basin, and as already said of cocoons generally, if it come off thick, cold water must be added until the proper temperature be attained.

For these six years past, I have been principally engaged in manufacturing, and the different processes of Silk Manufacture now carried on by me, at Dedham, Ms., I will briefly describe.

PROCESS I.—REELING FROM THE COCOON.

This process is performed by girls on my improved reel* which works better than the Piedmontese reel or any reel known to be in use, and is the

* Vide plate three.

same reel for which I received the premium of the Mass. Agricultural Society. The raw silk as it comes from this reel is a marketable article in any part of Europe, and is preferable to the silks which come from Bengal; upwards of a million of pounds of which are used in Great Britain annually.

PROCESS II.—WINDING FROM THE SKEIN THAT COMES FROM THE REEL TO THE BOBBIN.

This process is performed on the winding frame by girls and children; the silk runs from swifts over glass rods, and is guided by a traverse motion to its right position on the bobbin.

PROCESS III.—CLEARING THE SILK FROM KNOBS AND HUSKS.

This is done on the clearing frame by passing the silk from the bobbin over a glass rod through two plates of iron nicely graduated to another bobbin; the machine is tended by a little girl.

PROCESS IV.—SPINNING THE SILK SINGLE.

This is done by a man on the spinning frame. The spindles in this frame turn 1800 times in a minute, and the wheels are so graduated that any number of twists to the inch may be given.

PROCESS V.—TRAMMING OR DOUBLING THE SILK.

This is done by a girl at an engine constructed

after a model, for which a pattern was brought from a patented machine in England, which patent is still in force in England; but as their patent laws do not reach here, it has been put into use and operates well; by this machine the silk is doubled any number of times required, so as to make a thread of the size required, whether it be coarse or fine.

PROCESS VI.—THROWSTING OR TWISTING THE SILK.

This is done by a man on the throwsting frame, which is constructed on the model of one imported from England, and is so contrived by means of various small cog wheels, that the silk may be twisted any given number of twists to the inch. A man or a boy can tend one hundred spindles on this machine with ease, and turn off fifteen pounds of silk per day.

PROCESS VII.—STEAMING THE SILK.

This is done by submitting the silk when stretched upon the reels, as it comes from the throwsting frame, to the action of steam in a large receiver calculated for the purpose. The steam is raised in a tin vessel over a cylindrical stove, and passes into the receiver by a leaden pipe. The object of this process is to set the twist.

PROCESS VIII.—UNGUMMING OR CLEANSING THE SILK.

This is done by boiling the silk in soap and water in a large vat, for the purpose of clearing it from the natural gum, which is in all silk in its natural state. By this process the silk loses in weight about one quarter.

PROCESS IX.—DYEING THE SILK.

This is done by subjecting the silk to liquid dyes, and the different colors are produced with about the same ease that they are in woollen and cotton dyeing.

PROCESS X.—SOFT SILK WINDING.

This is done on an engine by girls in a manner very similar to that described in the second process, the object of it being merely to get the silk from the skeins to the bobbins. The silk is then fit for the weaver's use.

Thus the silk is carried through ten different and distinct processes from the cocoon to the weaver's use, each of which processes requires skill and care.

The silk is then taken by the weaver and warped and wove into any kind of stuffs required—handkerchiefs, vestings, satins, suspender-webbing and furniture binding have been made chiefly, as also stockings; but the weaving of broad goods is at-

tended with great labor, and as there is no protection by government on them of any consequence, I shall not be likely to make them in future to any extent.

### PROFITS OF MANUFACTURING.

The profits of manufacturing raw silk vary in proportion to its quality, and this depends much upon the manner in which it is reeled. In manufacturing three thousand pounds of raw silk the present year, my experiments have proved in manufacturing the Bengal silk a waste of from 9 to 15 per cent., on the Canton silk 5 to 12, and in the American from 2 to 5.

The expense of manufacturing a pound of foreign raw silk, is nearly as follows:

| | | |
|---|---|---|
| For winding, | 50 | cts. |
| doubling, | 17 | |
| spinning, | 10 | |
| doubling 2d time, | 10 | |
| spinning 2d time, | 10 | |
| reeling, | 10 | |
| knotting, | 6 | |
| dressing, | 40 | |
| papering, | 2 | |
| To which is added the value of the raw material, | 4 50 | |
| | $6 05 | |
| To which also add for use of power and machinery and waste, | 1 00 | |
| | $7 05 | |

Making the actual cost to manufacturer 7 dollars and five cents per pound for what he commonly values about eight dollars, or from eight to nine dollars at present prices.

This it must be recollected is an experiment, where the hands have been learnt and the machinery all prepared and in good order. To beginner who have all their acquirements to make, the expense must be greater. The patience and perseverance required to conduct the business, can only be estimated by those who have exercised them.

The machinery I have in use is from the latest English patterns, with some American improvements, an outline of which may be gathered from the following descriptions:

### THE MACHINERY OF THE SILK FILATURE.

#### REELING OF THE SILK FROM THE COCOONS.

Fig. 1 and 2 represent in plan and longitudinal view the reeling apparatus used in France.

*a.* The oblong water basin, heated by steam or a stove, commonly divided by transverse partitions, containing sometimes twenty cocoons, five in a group.

*b.* Hooked wires or eyelets to guide several filaments and keep them asunder.

*c.* Points where the threads run across each other to clean their surfaces.

*d.* Spiral groove, with a pin to give the traverse

motion to the thread, in order to spread it over the reel *e*.

*f*. Pulleys, which transmit by cords the rotatory movement of the cylinder *d* to the reel *e*.

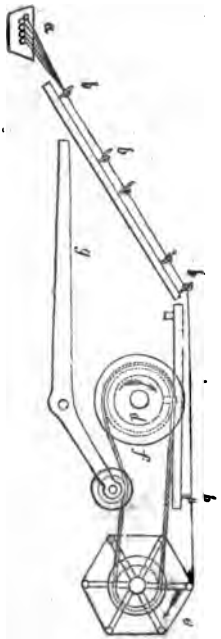

Fig. 2.—Cocoon Filature—Section of Reel.

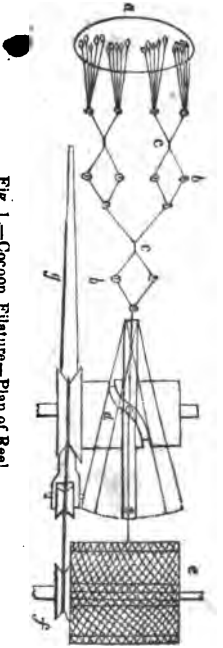

Fig. 1.—Cocoon Filature—Plan of Reel.

*g*. Friction lever for tightening or slackening the endless cord, in setting on or stopping the winding operation. There is usually a series of such reels in one apartment, driven by one moving power; but each of them, as shown, can be stopped at pleasure.

MACHINERY OF THE SILK FACTORY.

The first operation which raw silk undergoes in the factory, is its transfer from the skeins of the importer, upon bobbins in diagonal lines, so that the ends of the threads may be readily found in case of breakage. The bobbins are wooden cylinders of such thickness as not to injure the filaments by sudden flexure, which smaller cylinders would do, and to be able to receive a considerable length of thread without materially increasing their diameter, and of course their surface velocity in revolving.

Fig. 3 is an end view of one side of a winding machine, called the *engine*, to show how the motion is communicated to it; the other half, being similar, is omitted. It consists of a long wooden table A, for laying out the skeins upon, supported by strong slanting legs, as at B, on which are the bearings of the light iron reels C. These are called *swifts*, because, though they turn slowly round with the revolving bobbins, yet they do their work quickly compared with hand-winding machines. At every eighth or tenth leg there is a projecting piece D, which carries at its end a horizontal bar of wood *a*, called the *knee-rail*, for protecting the swifts from the knees of the work-people. The swifts have a stout axis of wood *b*, traversed by a central iron pin, round which they revolve, in the bearings of the legs B. On the middle of each

swift shaft *b*, is hung a loose ring (not visible in this view), to which a light weight is hung, for communicating friction to the reel, and preventing it from turning round, unless as it is drawn with a

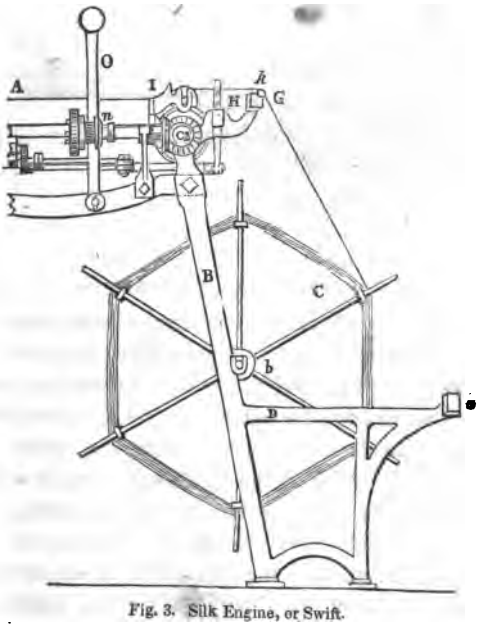


Fig. 3. Silk Engine, or Swift.

gentle force by the thread in its winding upon the bobbin.

The bevel wheel 2 is fixed to the end of the long driving shaft, seen magnified at E (fig. 4), on which

are fixed a series of light wheels *g* (fig. 4), called *stars*, which bear the bobbin-pullies, and turn them round by friction. To the table A are screwed the light cast-iron slot-bearings I (figs. 3 and 4), for receiving the ends of the horizontal iron spindles,

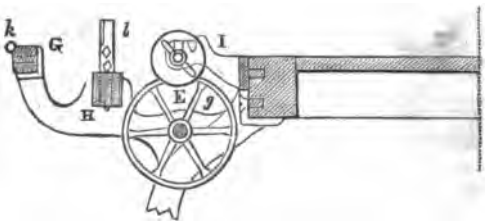


Fig. 4.—Bobbin Mechanism of the Silk Engine.

on which the bobbins are mounted for revolving. G is a wooden bar seen in cross section, which rests on every tenth or twelfth leg B of the engine, and carries on its edge a slender glass rod *k*, over which the silk threads glide smoothly from the swifts to the bobbins. At H is the *guide rod*, endued with a lateral or traverse motion, in slots or notches of the arms which carry the bar G. On the rod H are fitted the guides *l* (fig. 4), which consist of two upright blades of iron, with their edges approximated, so as to form a narrow slit between them adjustable in its width by a screw. This slit-piece, is called the cleaner, as it serves to scrape the surface of the threads, to remove any loosely adhering roughness, or to stop altogether their winding on

when a knot occurs. The upright lever O, with a ball at its top, is the *geering-rod*, which being turned a little one way or other, moves the clutch *n*, or locking apparatus, so as to attach the main shaft E, and its range of bobbins, to the driving power, or to detach it at pleasure.

2. *Doubling Engine.* In the doubling of silk, where two or three threads are wound parallelly together upon one bobbin, an ingenious contrivance is employed to stop the winding on, whenever one of the threads happens to break. Fig. 5 shows the mechanism in section, and fig. 6 in plan; for one half of the doubling engine. A is one of the end frames, which are connected at their tops by the bar-beam *a*, a plank which extends the whole length of the machine. At B are the creels for laying the bobbins *b b*, with their ends in slots. D is the end of the horizontal iron shaft which runs through the engine, and carries a series of light wheels *c*, which bear the winding-on bobbins E, and turn them by friction at *d*, as in the winding engine already described. G is the guide bar, to which are fixed the clearer slit-pieces *g*; *h h*, fig. 6, are two polished steel rods, between which the faller eyes *n n* (figs. 5 and 6), work. I is the lever board, which bears the lever *k l*, with the fallers *n n*, for stopping the winding-on in case of breakage of a thread. On this board, the light brass props or fulcrums *i i* are fixed, one corresponding

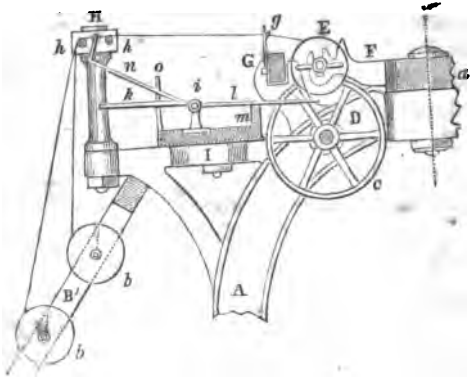


Fig 5.—Mechanism of Silk Doubling Mill.—Section.

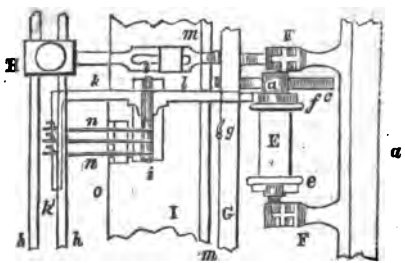


Fig. 6.—Mechanism of Silk Doubling-Mill.—Plan.

to each creel-bobbin. The slight balance levers *k l* swing on a wire axis, which passes through these props; their arms being formed as shown at *k k'*, fig. 6. The arm *l* is the heavier of the two, and naturally rests on the ridge bar *m* of the lever

board I. *n n n*, are three wires resting at one of their ends on the fulcrum axis *i i*, and hanging each at their other hooked end (seen under H in fig. 5) to one of the silk threads, where it passes over the steel rods *h h*. These wires are guided in their up and down play with the motions of the thread, by a plate *o*, furnished with a vertical slit. Hence whenever one of the threads chances to break on its way to the winding bobbin E, the wire *n*, which was suspended by its hook to that thread between the steel rods in the line of *h h* (fig. 5), falls upon the arm *k* of the balance-lever *k l*, weighs down the arm *k*, raises of course the other arm *l*, and thrusts its end into one of the three notches of the ratchet wheel *f* (seen in its place in fig. 6, and separately in fig. 7.) Thus the winding bobbin is

Fig. 7.

held fast till the attendant having pieced the ends of the thread, and hung up again the faller wire *n*, causes the lever *l* to take the horizontal position. If the attendant had meanwhile moved the winding bobbin out of that slot-bearin, which lets its pulley *d* rest on the star-wheel *c*, into the adjoining slot-bearing, seen in fig. 6, where it remains motionless, she must now restore it to its revolving position.

3. The machine for twisting the single threads

of silk either before the doubling or after the doubling, is called the *spinning-mill*, sometimes also the throwing-mill; though the latter term often includes all the departments of the silk-mill. The section of this apparatus in fig. 8 shows two equal working lines, namely, one on each side of the frame.

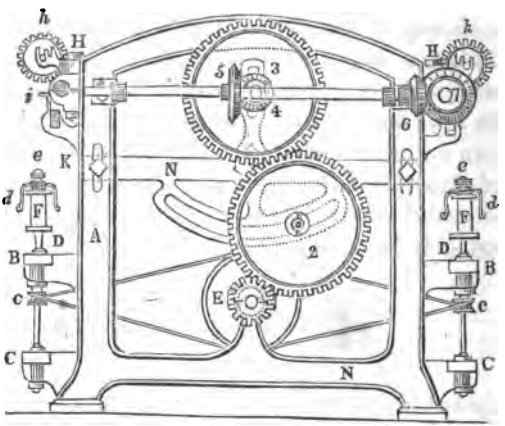


Fig. 8.—End view of an improved Silk Spinning Mill.

A A are the end frames or uprights, bound with cross bars N N; and two or more similar uprights are placed intermediately between the ends. They are all connected at their sides by beams B and C, which extend through the whole length of the machine. D D are the spindles, having their top

bearings fixed in the bar B, and the bottom or step bearings in the bar C. These two bars together are called by workmen the spindle-box: *c c* are the wharves, turned by cords passing from the horizontal tin cylinders E, which lie about the middle of the mill, midway between the ranges of spindles. F F are the bobbins with the doubled silk, which are fixed on the tapering spindles by pressing them down: *d d* are little flyers, or forked arms of wire attached to a disk of wood or washer, which revolves loosely upon the top of the said bobbins F F, and round the spindles, one of their arms being sometimes bent upwards to serve as a guide to the thread: *e e* are pieces of wood pressed on the top of the spindles, to prevent the flyers from being thrown off: *h h* are the ends of the winding bobbin shaft, laid in slots near H, as in the former machines. The winding bobbins are driven by toothed wheels, cast on one end of their square iron axis, in the line of *h*, which wheels are turned by toothed wheels on a bar in the line of the bevel wheel 7. On these bobbins, which are of considerable diameter, the silk is wound, and distributed diagonally by a peculiar differential mechanism. K K are the guide bars, with the guides *i*, through which the silk passes, being pulled by the winding bobbins on their horizontal shaft in the line of *h*, and delivered by the flyers *d d*, from their vertical twisting bobbins and spindles F. By the revolution of the tin

Reeling is then commenced on a common hand reel, (such as is in common use in families in New England for reeling yarn from the spinning wheel,) and the silk fibres run off about as fast and with as little difficulty as yarn from a spindle. Some of the cocoons run off before others; and when on this account the thread becomes too small, all the fibres are broken off, and what is reeled is tied by itself on the reel and another quart of cocoons is thrown into the kettle; the ends are collected and reeled in the same way as before, and each separate piece is tied by itself. When the reel is full the pieces are all tied together, taken off and immediately dried.

Most of this silk is manufactured into sewing silk and twist in the following manner: — It is immersed for a few moments in boiling water, taken out, put on swifts and spun or twisted on a common woollen wheel, beginning at the large end of the piece, that is at the end which was reeled first: and when it becomes too small, which is the case when one half or two thirds is run off, the small end of another piece is added to it, and thus they are twisted together. It is then spooled directly off the spindle; a sufficient number of spools is put into a small spool frame to make a thread of a proper size, which is twisted again while it is moist. It is then reeled again and cleansed by boiling in strong suds for three hours, then dried and colored. Undergoing this

process it shrinks about one half in weight; after this, for sewing silk, it is doubled, twisted and reeled on a reel two yards long, and is divided into skeins of twenty threads each, as the statute of that State requires. If it be calculated for twist, it is made three threaded, twisted and done up into sticks with a small hand machine, and is then ready for the market. The floss, or tow, as it is called, is boiled in strong suds for three hours, dried, picked, carded, and spun on a common wool wheel. The yarn is woven into cloth, which is worn by the women for every-day gowns. It is sometimes manufactured into very strong and durable carpets.

Those cocoons that the grubs have pierced are boiled as above and dried. The end that is not pierced is cut off; they then are spun on a linen wheel like worsted, beginning at the end cut. It is then twisted together, three threaded and knit into stockings.

The imperfect cocoons, and all that will not reel, are boiled, carded, spun and manufactured in all respects like floss, but they make nicer and finer cloth.

The Connecticut domestic sewing silk, at present, does not bring a higher price than the reeled silk as it comes from my reel. As it is said that there is a loss of one half of the weight in the preparation

of sewing silk, it is evident that to reel it properly and sell it for raw silk would bring a hundred per cent. more profit.

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### GIDEON B. SMITH'S IMPROVED SILK REEL.

(SEE PLATE.)

This is an improvement on the Silk Reel of Piedmont. The improvement consists in the simplicity of the machinery, compared with that of the Piedmontese Reel, the operation of both being exactly the same. A, is a cylinder eight inches diameter and eight in length. B, a circular groove, half an inch deep, which has a sweep of six inches. To lay out this groove, a strip of paper six inches wide and of the exact length of the cylinder's circumference, is doubled, and with the compass a sweep is made from the middle of one end of the double paper to the edge and thence to the middle of the other end; the paper is then turned over and the same sweep made on the other side, in an opposite direction. The paper is then laid on the cylinder, and the groove marked upon it for cutting. Thus on each side of the cylinder the groove will form a semicircle meeting in the middle, and will thus cause a peculiar motion to the traversing bar, (C,) which it will cause to move

slowly at the extremities of its course and rapidly in the centre, thus giving time for the threads to take hold of the rails of the reel on the outside of the skein before it begins to move back. C, the traversing bar, with the brass hooks through which the silk passes. D, a bar of the frame on which a brass plate is fixed, with small holes, for the silk to pass through, and which stands immediately over the vessel containing the cocoons. E, the drum, eighteen inches diameter. F, the pulley, ten inches diameter. The size of the drum and pulley precludes the possibility of the band slipping.

The whole frame is five feet long, four high, and two wide in the clear, and the timber about two inches square. It is put together with keys, for the convenience of taking down and putting up.

The necessity of the machinery for producing the vibratory motion of the traversing bar, will be understood when it is stated, that, if the threads are laid on the rails as cotton is reeled they would adhere and become useless, as they could not be separated. The traversing bar causes them to be laid on in such a manner as to obviate this entirely. By a small handle near the rim of the drum, the reel is turned. With this reel the relative proportionate diameter of the drum and pulley is necessary, to produce the proportionate movement of the traversing bar, and the revolution of the reel, as the bar must move back and forth five times,

while the reel makes nine revolutions, and as the groove is formed, one revolution of the cylinder causes the bar to move out and back once. This reel I have not seen, but give the description of it as published.

# APPENDIX.

(A.)

## SHORT HISTORICAL ACCOUNT OF THE EFFORTS OF SILK CULTURE IN THIS COUNTRY.

In America the culture of the silk worm was introduced into Virginia in 1623, by James I., who himself composed a book of instructions on the subject, and caused mulberry trees and silk worm's eggs to be sent to the colony. He made great efforts to have it take the place of tobacco in agricultural pursuits. Thirty years afterwards it was enacted that every planter who should not have raised at least ten mulberry trees for every hundred acres of land in his possession, should be fined ten pounds of tobacco. Five thousand pounds of tobacco were promised to any one who should produce one thousand pounds of wound silk in one year. In 1664, Mr Walker, a member of the legislature, stated that he had seventy thousand mulberry trees on his estate. In 1666, all statutory provisions were repealed, because the business was in so thriving a condition as no longer to require protection. The decline of silk business in that state was probably owing to want of perseverance. The new emigrants brought with them new views and habits; and as they brought their slaves, it became necessary that an immediate annual profit should be realized. Hence the culture of rice and indigo was introduced, and on account of the immediate profit derived from their culture, that of silk

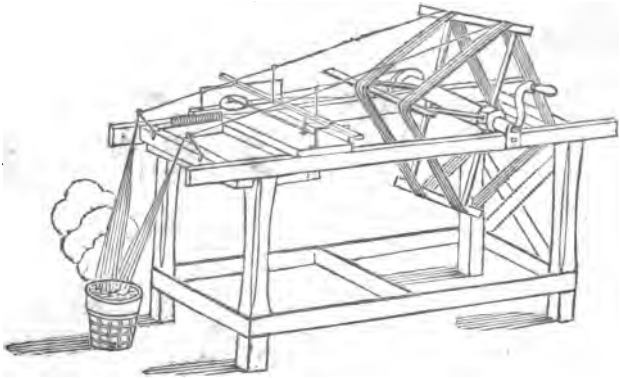
languished, which would have required a steady perseverance for a course of years.

The culture of silk was introduced into Georgia at the earliest period of its settlement. The trustees of the colony transmitted mulberry trees as well as seeds and silk worms' eggs. The public seal of the colony represented silk worms in their various stages. In the year 1736 a quantity of raw silk was raised in that colony, and was manufactured at Derby, by Sir Thomas Combe, into a piece of stuff and presented to the queen. A few years before our Revolution considerable quantities of raw silk began to be exported to England, which was found equal to the best silk of Piedmont, and to be worked with less waste than the China silk. In 1776 more than twenty thousand pounds of raw silk were imported into England from Georgia.

No result of any consequence seems to have followed the exertions of Dr Franklin to establish a filature at Philadelphia in 1769. The Revolution came on and put an end to the undertaking. There is little doubt that if the United States had continued to remain British Colonies, the culture of silk would have made an immense progress in this country, because its promotion was a matter of vital interest to the mother country, whose manufacturers would have been furnished from hence with the raw material, which they are obliged to purchase at a great expense, drawing very little from their dominions in Bengal, where it seems it is imperfectly prepared.

In Connecticut this culture has been attended to for seventy years, and it is probable that about four tons are now raised annually in the county of Windham. I was told by an intelligent citizen of that county during my visit there in 1828, that the culture was found profitable and was the best business they could pursue. I found many families, in some towns nearly all engaged in raising silk. A family makes ten, twenty, fifty, or a hundred pounds in a season, according to their supply of leaves. It is evident

*PLATE III.*



J. H. COBB'S REEL.

that they will derive much advantage from introducing European skill into their manufacture of the article. I am told that during the present season they have erected a factory and employ several European artists. There is every reason to believe that a rapid increase of production will soon take place in many of the states of the Union. In New Hampshire, Vermont, and Maine, silk has been cultivated in small quantities with success. Individuals in Massachusetts have cultivated it with success for thirty years, and there is not, probably, a farm in the state on which it may not be raised. The beautiful specimens of the article produced at the agricultural exhibitions in different parts of the Union show the degree of interest excited at the present time on the subject, and indicate that at no distant day great national wealth will be derived from the exertions that are now undertaken in this department.

(B.)

EXPLANATION OF THE SILK REEL OF PIEDMONT.*

The frame is 6 feet 5 inches long, 4½ by three inches thick. Distance of the upright posts, AB, 4 feet 4½ inches.

CC. Length of the braces of the frame, 20 inches in the clear.

DD. Legs of the frame, 2 feet 3½ inches long. E, shaft with a crown wheel at each end. The wheel F, 9 and one tenth inches in circumference, has 22 teeth. The wheel G, 10 inches and 2 and one tenth in circumference, has 25 teeth. This shaft has an iron pin at each end 1 inch long. The pin at the end G, plays in a hole in the shoulder near the top of the post O, so as to enable the teeth of the wheel to catch and work in those of the pinion at the end of the axle of the reel, which axle, by means of a pin at the end, also plays in a hole in the post O. The pin at the

* See Plate.

other end of the shaft plays in a hole in the post K, and the teeth of the wheel F, work in the pinion H, fixed on the top of the post K, by means of a burr screwed on the pin projecting from the post and passing through the centre of the pinion. This pinion has 35 feet. On the top of the pinion H, is a crank, having a sweep of 4 inches, and receives on its top the end of the iron wire-carrier of the traversing bar I. The crank is fixed half an inch from the commencement of the grooves of the pinion. This crank is shown in the figure H. I, a traversing bar, 2 feet 10 inches long, ⅛ of an inch wide, ¼ of an inch thick, playing through the posts BK ; height of the post from the frame 17 inches.

L. An iron carrier of wire, No. 1, 18 inches long, fixed to the bar I, to work free by a screw. The other end is fixed by a burr to the pin passing through the centre of the pinion H.

MM. Two wire hooks or eyes,.(rampins) 7¼ inches apart, at equal distances from the ends of the traversing bar through which they pass. The wires to the commencement of the turns of the hooks are 5 inches in length.

N. The reel ; arms, 2 feet 2 and one tenth inches long in the clear : 1½ inches wide, and eight tenths of an inch thick ; rails, 20¾ inches long, 2 inches broad, and eight tenths of an inch thick ; two of the arms are jointed, to allow the skeins of silk to be taken off when reeled and quite dry. There ought to be an extra reel to put in the place of the one taken off to prevent the work stopping.

O. Upright support for the axle of the reel, on the ends of which the pinion is fixed, to work with the wheel G, at the end of the shaft E. The pinion of the axle has 22 teeth. P, an iron plate with four holes, 12 inches long, slightly hollowed, projecting 3½ inches from the bar : the outside holes are 3 inches from the ends ; from the centre of one hole to that of the next, ¼ of an inch. Distance from the two inside and nearest holes, 4 and two tenth inches.

Q. The copper basin to contain hot water, in which

the cocoons are immersed when reeling off. It is 18 inches long, 1 foot broad, and 4½ inches deep.

R. The furnace to contain charcoal, to keep the water hot.

Distance from the centre of the posts AB and OK, 36½ inches. Circumference of the reel 6 feet 11 inches.

Distance from the top of one arm, where it enters the rail, to another arm, 18½ inches.

From the axle of the reel and the traversing bar, I, 4 feet 8 inches.

(c.)

MORUS MULTICAULIS.

Since the publication of my manual in 1833 in which I recommended to our nursery men to propagate this plant, it has been multiplied very extensively; so that at present there are no doubt more of these trees in America than in Europe. The Messrs Winship, at Brighton, and Mr. Kenrick, of Newton, and Mr. Prince, of Long Island, have large quantities of them. But the supply at present is no ways adequate to the demand. They are rapidly extending over the South and West, where the fertile soil and mild winters seem better adapted to them than in New England. The greatest height that I have had one attain here in a single season was seven feet, and this was grafted on a stock of common white mulberry near the ground and stood in very rich soil, in a sheltered situation. They usually attain to an average height of two and a half feet from the cuttings in a single year. From Gideon B. Smith's account of it, which follows, it is much more flourishing at the south. He says, it is continually sending up young shoots from the crown of the root, and when these become numerous, and the tree six or eight years old, some of the oldest stocks die out; but whether from natural decay, or being perished by their vigorous young brethren, I am unable to say. My old tree has been as high as fifteen

feet, six or seven feet of which was young wood ; but as I generally cut off most of the young wood for propagation, it has never exceeded that height ; the leaves when full grown on the vigorous wood are 12 to 15 inches in length, and 10 to 13 inches wide. The rapidity of their growth causes the ribs to grow faster than the web of the leaf, and hence the large leaves are always concave so that they cannot be spread out flat without tearing them from the edges to the middle rib. The leaves are so heavy that they always hang pendulous, and folded somewhat like a towel hung upon a nail. The surface of the leaf has some glossy appearance on the outer surface, but is a little rough to the touch. The fruit of the multicaulis is very black when ripe, and when crushed, yields an intense purple juice, the stain of which is exceedingly difficult to wash out. The fruit is about the size and form of the white mulberry, but generally contains very little good seed, probably my old tree never produced more than 20 at one season ! The general characteristics of the shrub are the same in this latitude, but as the frosts have proved very destructive, the plants are taken up in the fall, and put in loam in the cellar or buried up in the field about a foot deep and in this way are preserved, and the whole trees are planted, laid lengthwise, in a furrow, about the depth corn is planted, in this manner one tree produces from five to ten. But a more rapid mode of propagation is by laying down in well prepared drills, cuttings of single buds at suitable distances ; in this way, if the ground is kept in a proper state of moisture, each bud will become a tree and put out roots on its own account. Cuttings of two eyes are set in an angle at the inclination of forty four degrees, leaving one bud out of the ground near the top and found to do well.

The greatest number of buds that I have had from a shoot of this kind in one year is 132. The main stem or side branches may be laid down in June or July, and be made to produce from each bud by tying a fine wire round the stem between the buds. I have succeeded in obtaining a great increase in each of these

ways. And as the propagation in these ways succeeds so well, I shall not attempt to raise them from the seed especially, as it is generally believed the plant from the seed will be of different variety. Others in different parts of the union have succeeded as well, as I shall proceed to show. In Florida I find the plant flourishes with great vigor, if I may believe the account published in May 1836, in the Silk Culturist.

About the middle of December last, I saw, says the writer, in the garden of Rev. Mr Thomas at St Augustine, seventy Chinese mulberry trees; the tallest of which were about four feet, and others down to one foot, but all very flourishing and full of foliage, this miniature forest was contained in a space of 10 by 2 feet, and was all the products of one small tree, say six feet long, which was transplanted to that spot three months before, viz: the middle of September. It was set out, and then the body bent down and buried in the sand, and these young trees had come up from that and the lateral branches.

So much for the extreme south. The plant is found in Maine, in the other extremes of the United States, where the wood that has been thoroughly ripened, has been left exposed to the rigor of winter without being injured by the frost. High land, the sides of hills and exposed situations seem best adapted to favor the ripening of the wood, securing them from the ill effects of the frosts. The leaves which are produced on low and moist soils are apt to be rusty, and are less nutritive than those in more elevated situations. Mr Kenrick in his valuable treatise, in the Silk Grower's Guide, has the following remarks:

"The silk which the worms form from the food afforded by this plant is not only of the finest quality, but the cocoons are of unusual size, and the fibre of superior strength. The leaves, from their extraordinary dimensions, are gathered with important economy of labor and of time, and from their superior nutritious qualities, they are preferred by the insects to all others.

This mulberry should be cultivated in hedge rows, and never suffered to rise higher than seven or eight feet. But a few years are sufficient to raise considerable fields of them in full vigor, sufficient to support an immense number of silk-worms; and regular plantations can be formed, by planting the trees at the distance of from six to eight feet asunder; or in rows of eight feet asunder, and the trees at three or four feet distance in the row; a space sufficient for the extension of the branches, sufficient also for cultivation, and for the greater convenience of gathering the leaves. So greatly is this last operation facilitated by the flexibility of the stalks, and the superior size of the leaf, that, as we are assured by M. Perrottet, a child is sufficient for gathering the food for a large establishment of silk-worms.

The *Morus multicaulis*, since its introduction to France, seems destined to replace everywhere the common white mulberry for the nourishment of silk-worms, such is its decided superiority over all others. M. Bonafoux, the director of the Royal Gardens at Turin, and the celebrated writer on silk, has also fully attested its decisive superiority in Italy, where he has found, that by close planting and low pruning, whole fields may be suddenly covered with a mass of the most luxuriant foliage. He has tried them extensively. And M. Dupont, of Chiron, near Chamberry, in France, has found that as the silk-worms fed on this mulberry make less waste of litter and of food, so the chances of disease are diminished from this cause, and they finish their labors in three days less time, and that the silk has a more brilliant lustre. He has also found that the saving of labor in gathering the food is so great, that ten quintals of the leaves of the *Morus multicaulis* are gathered with the same labor that is required to gather two quintals of the common white mulberry. By the most perfect rules of pruning, he makes this mulberry assume the form of a quenouille or vast distaff, fifteen feet high, the form to be always preserved.

This mulberry braves the most rigorous winters of France. Of this important fact we have the indisputable testimony of M. Poiteau and others; even of the uncommonly severe winter of 1829–30: it has there been acclimated, even to the extreme north, as far as Havre; and where it has been cultivated by M. Eyries, from its first introduction to that country.

Dr. Deslongchamps, in his experiments at Paris, had found, that the cocoons produced by the silk-worms which were fed exclusively on the Chinese mulberry were even rather heavier than other cocoons. And in the report on this mulberry to the academy of Dijon, in August, 1834, by M. Tilloy, it appeared by accurate experiments, that the cocoons produced from this mulberry being rather heavier, the fibre was consequently stronger than that of other cocoons; as it was remarked in winding, that of the whole of these, three hundred and eighty four cocoons in number, not a thread was broken, which was not the case with the other cocoons.

Near Montgeron in the north of France, the French government have established an experimental silk farm, under the direction of M. Camille Beauvais; and the extraordinary experiments which are there in progress were published in 1835. Already has he succeeded in producing thirteen pounds of silk from the same number of silk-worms which in France usually produced but five pounds, and in Italy seven and a half pounds, and in India twenty pounds; and even in that climate he expects soon to be able to produce an equal number of pounds. And Gen. Talmadge, who has lately visited the establishment, has stated in a letter dated April, 1836, at Paris, that when the leaves of the different kinds of mulberry are mixed together, the worms will select and gather on the Chinese mulberry. And Madame Parmentier has found on trial at her late establishment at Brooklyn, New York, that the silk worms left seven other species of the mulberry to feed on this.

In Tuscany, so fine is their climate that two suc-

cessive crops of silk are annually produced by the common mulberry; and Dr Deslongchamps has proved, that by aid of the Chinese mulberry, two crops of silk may be annually produced even in the north of France. Our climate is far more propitious than theirs, and at least as favorable as that of Italy; since in the south of that country, the pernicious sirocco, a dreadful south wind, sometimes strikes whole communities of silk-worms dead. The cocoons of the second crop which were produced by Madame Parmentier, being fed exclusively on the Chinese mulberry, were of a brilliant and snowy whiteness. Those also which were exhibited at the fair of the American Institute, in New York, in 1833, of the first and second crops, both being fed exclusively on the Morus multicaulis, completed their labors before midsummer; these cocoons were also of a snowy whiteness.

At the government establishment near Montgeron, in 1835, there was 67,000 mulberries of different species, set out and in a flourishing state, including a great number of the Chinese mulberries; these were kept low by pruning. M. Beauvais founds his expectations, his sanguine reliance, on this mulberry alone, for the production of the second crop of silk.

The prediction of the late Dr. Pascalis, in 1830, that "*after the discovery of this plant, a doubt no longer exists that two crops of silk may be produced in a single season;*" this prediction has since been accomplished—its truth fulfilled by experiment. The soil and cultivation, the habitations for the successive generations of silk-worms, being yet the same, all thus converted to *double* use, and the production of a *twofold* harvest, it will be obvious that the actual profit, thus augmented, must be manifold.

In a report on this mulberry which was made to the Academy of Dijon by M. Tilloy, of the Medical Jury of the Department of Cote D'Or, August, 1834, it is stated that in the same situation, time, and temperature, five hundred silk-worms were fed on fifteen

pounds of the White Mulberry, and five hundred other silk-worms were fed on fifteen pounds of the leaves of the Morus multicaulis; both finished in the same time. Of the cocoons produced from the White Mulberry it required four hundred and twenty to the pound, while of those produced from the Morus multicaulis, it required but 384; both gave two ounces of very fine silk to the pound, of equal beauty; but it was remarked that in winding the cocoons fed from the Chinese Mulberry, not a thread was broken, which was not the case with the others.

It appears from the deliberations of the French Royal Society of Horticulture, (as noted in the Farmer's Register) that the Chinese Mulberry or Morus multicaulis is not a distinct species, and that as a new and invaluable variety, it can only be preserved by multiplying it from grafts, layers, and cuttings; and that by these means exclusively have the Chinese cultivators reared the tree from time immemorial. And M. Maupoil, a Frenchman settled at Lombardy, who propagates the Chinese Mulberry by every mode, has found that plants raised from seed tend to approach in character the common White Mulberry; thence he recommends its propagation by slips and grafting exclusively. Seeds sown near Venice, have, it is further stated, produced varieties, but none like the true Morus multicaulis.

For the following excellent remarks on the virtues and mode of culture of the *Morus multicaulis*, the public are indebted to the valuable "SILK MANUAL" of Mr Roberts, the editor of the *Farmer and Gardener*, which is published at Baltimore. This communication is from Gideon B. Smith, Esq., who was formerly the editor of the "*American Farmer*." Higher authority than Mr Smith, as a gentleman practically acquainted with his subject, I need not name. From this communication I have extracted largely, as I deem it very important.

"*Editor Farmer and Gardener:*

"SIR,—Having seen many statements and suggestions in the public prints, that the Chinese Mulberry, *Morus multicaulis*, was not as hardy as the White Mulberry, that it would not bear the extreme cold of our winters, &c., I deem it proper to state my own observations on the subject. I was the first person south of New York, who had the Morus multicaulis. It was sent to me by my old friends, William Prince and Sons, in 1828, in a collection of seven other varieties of mulberry, but under another name.

About a year after I received it, accounts were received from France of the receipt there of the Morus multicaulis, and of its great value for feeding silkworms. I immediately commenced feeding my silkworms with the multicaulis, and from experiment ascertained the truth of all the French had said about it. From that time to this, I have continued to urge upon all, the propriety of cultivating this, in preference to the white mulberry.

Its advantages are:—it is *fully as hardy* as the white; one pound of its leaves contains as much nutritive matter as a pound and a half of the white; the silk made from it is of a finer texture and more lustrous; its leaves are so large, that a pound can be gathered at half the expense and trouble that a pound of white mulberry leaves require; it can be cultivated with infinitely more despatch than any other kind. These are all great advantages, and I am so well convinced of the correctness of this statement, that I do not hesitate to say, that within ten years, no other mulberry will be cultivated for feeding silkworms; simply because those who feed silk-worms upon white mulberry leaves will not be enabled to compete with those who feed on morus multicaulis, and they will be either compelled to abandon the silk business, or adopt the multicaulis for feeding. In relation to the hardiness of the morus multicaulis, I have to remark, that I have cultivated it for *seven years;* never protected it in any manner whatever,

and never lost a tree by the cold of winter or in any other way. I had fifty young trees in my garden last winter, and not even a bud on the extremity of the branches was injured. It is true about 50 yards west from where the young trees stood, there is a grove of oak trees, and on the north 50 yards distant, my dwelling house stood; and the garden has an exposure to the south with a gentle declination. But my residence in the winter of 1831–2 was very different. It was a farm four miles in the country in a north-east direction: the situation at an elevation of 300 or 400 feet above tide water. There my morus multicaulis had an open exposure to the north-west wind; yet none were injured. During the whole time, I have had the white mulberry of several varieties, and have observed that they were all equally hardy—none more so than the multicaulis. I have seen the young *unripened wood* of all the varieties destroyed by winter, and was very early led to adopt measures to guard against it, and how I never lose a *bud*."

"None but the young trees are ever injured by winter, and all we have to do is to give *them* such a start, as to enable them to ripen their wood previous to the approach of very cold weather.

"After the first year, I have never seen any of them lost by winter, except in some extra cases, and in these cases, the white mulberry has suffered, and even the native mulberry, fully as much as the multicaulis. Last winter, a white mulberry tree, seven or eight years old, in the western part of the city of Baltimore, was killed to the ground; while my morus multicaulis, not a quarter of a mile from it, and north of it too, and in a higher situation, was not injured."

"In fine, Sir, I am in no way interested now in the business of raising mulberry trees or silk, so that I can be influenced by no mercenary consideration in giving my opinion as above, and therefore, the more dependence may be placed on these suggestions. The

manner of propagating as above described, is my own discovery, and has been practised by me four years with invariable success."

Mr Smith differs from the opinion I had adopted on the authority of the French, and seems persuaded that this mulberry is a *distinct species*, as is the alba, rubra, nigra, &c.

The plan recommended by Mr Smith as above, and which originated with him, consists in raising the trees from cuttings in a hot bed. These are prepared and planted early in March, and placed three inches asunder; the eye so buried as to be barely visible at the surface, and covered with glass. The bed is occasionally watered and protected from frost at night, and a scorching sun at mid-day.

By the middle of May, the plants will be six inches high, and may be transplanted to the open ground, and watered daily till rooted. If the weather is dry, they will ripen their wood, and need no protection in the first winter."

It is undoubtedly true that many of these trees have been lost by the winter in the Northern States. The reason of this has been, that the trees were suffered to grow till the frost came, and the wood had not sufficient time to harden and ripen; many of our forest trees would share the same fate if subjected to the same treatment; if the tops are green and succulent when the frost comes, the roots also are alike unprepared for the attacks of winter, and it would be unreasonable to expect any thing but an entire loss. If however, the trees are set on poor land, and manured in the early part of the season, and the cultivation entirely neglected after the middle of August, the tops even to the outside buds, have time to ripen and harden; the buds fall off in October, and the buds are well formed, and the roots also are in good condition to stand the winter. I had this exemplified in my own trees the present season; a part I set in low ground and manured and cultivated through the season, grew rank and luxuriantly till the frost

came, and consequently would have been lost if I had not secured them by taking them up. In another part of the same field, on a side hill in poorer land, the ground being manured in the early part of the season, the growth was checked in the latter part and although not near so large as the others, were well ripened, the leaves dropped off, and the buds even to the tips of the branches were well formed and hard; consequently these trees were more valuable though not more than half the size of those in lower ground.

(D.)

## SILK WEAVING.

The weaving of silk in India, is carried on in the most simple and rude manner, in the open air. The weaver selects a station under a large tree to protect him from the sun; he then extends the threads of his warp between two bamboo rollers, which are fastened to the ground by means of wooden pins. He then digs a hole in the earth to contain his legs while setting; he then attaches to a limb of the tree his harness, and with his toes in the lower shafts and his shuttle in hand, manufactures the finest and most delicate fabrics.

The art of weaving silk varies but little from that of other fabrics, and most beautiful specimens of plain weaving have been produced in different parts of our country, in the simple looms in common use for weaving cotton and linen.

A small hand loom for weaving the Tuscan braid, composed of silk warp and straw filling, was first started by me, and many hundreds of them have been in operation to make the material for ladies' bonnets. These looms are now made and sold at a cost of five dollars only. In the same loom may be wove various narrow silk goods, such as gimps, ribbons, suspenders, webbing and fringe. The cotton warper will answer for the silk with some trifling variations.

Broad hand looms have been operated with us, and handkerchiefs, gros de Naples, waistcoatings, &c., have been made of surpassing beauty; but the great objection to hand weaving with us is the high price of labor.

The power loom has been put into use and succeeds well in the coarser fabrics, and especially in those where the warp is used with the gum in it. The cotton manufacturers are obliged to make an artificial sizing for their warps, and large quantities of flour are brought into use in every cotton mill for this purpose. But the silk has a natural sizing or gum in it, which therefore needs no such artificial preparation for the coarser stuffs, and vast quantities of it may be wove in the common cotton power loom with the warp in its natural state, and the filling in a prepared state. But for the more delicate weaving, power looms have not yet been used to much advantage; it is found that the silk in its prepared state is tender, and gives so much trouble to the weaver, by delays in mending the warps and *picking the pot ry*, as it is called, that nothing is gained by power looms.

Figure weaving has been very much simplified in Europe, by means of the Jacquard machine; but as the description of it would be somewhat tedious, I refer the manufacturer to Dr Lardner's Cabinet Cyclopedia, where all important information in relation to it may be found, as also for the weaving of gauze, velvets, brocades, damask, &c.

### COST OF MANUFACTURING.

The expense of manufacturing a pound of silk into Gros de Naples, I give from Dr Lardner, as it is both in France and England; the expense of the preparation of the silk is not more in this country than in Europe; but the hand weaver must be paid greater wages, and this prevents competition at present.

| *In Lyons.* | £ | s. | d. |
|---|---|---|---|
| Price current of organzine 25*s.* per lb., 8 ounces of which | 0 | 12 | 6 |
| Ditto of tram 22*s.* 6*d.* per lb., 8 ounces of which | 0 | 11 | 3 |
| Dyeing warp and shoot | 0 | 0 | 11 |
| | 1 | 4 | 8 |
| Add 4 ounces for loss in dyeing and waste, to make 16 ounces when manufactured | 0 | 6 | 2 |
| | 1 | 10 | 10 |
| Winding & warping 1*s.* 3*d.* | | | |
| Weaving 16 yards, reckoning 1 oz. to the yd. at 4½*d.* per yard | 0 | 7 | 3 |
| | 1 | 18 | 1 |
| Difference in favor of the French manufacturer | 0 | 5 | 6 |
| | 2 | 3 | 7 |

| *In London.* | £ | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|---|
| Price current of fine tram silk in Italy | 1 | 2 | 6 | | | |
| Export duty and expenses | 0 | 0 | 6½ | | | |
| Carriage to Calais | 0 | 0 | 3½ | | | |
| per lb. | 1 | 2 | 4 | | | |
| Eight ounces of which | | | | 0 | 11 | 2½ |
| Price current of fine organzine in Piedmont | 1 | 3 | 9 | | | |
| Duty and expenses | 0 | 0 | 9½ | | | |
| Carriage to Calais | 0 | 0 | 3½ | | | |
| per lb. | 1 | 4 | 1 | | | |
| Eight ounces of which | | | | 0 | 12 | 0½ |
| Dyeing warp and shoot, black and ordinary colours, soft and souple | | | | 0 | 1 | 6 |
| | | | | 1 | 4 | 8½ |
| Add 4 ounces for loss in dyeing and waste, to make 16 ounces when manufactured | | | | 0 | 6 | 2 |
| | | | | 1 | 10 | 10½ |
| Winding and warping | 2 | 0½ | | | | |
| Weaving 16 yards, reckoning 1 ounce to the yard, at 8*d.* per yard | 10 | 8 | | | | |
| | | | | 0 | 12 | 8½ |
| | | | | 2 | 3 | 7 |

(E.)

## DYEING OF SILK.

Most silks lose in boiling off the gum, about one quarter of their weight. This process is indispensable to prepare them for dyeing and to give the requisite lustre; hence for the darker colours, the extreme whiteness of the raw silk and shiny appearance, is of little consequence, as it is all submitted to this process, by which its original properties are in some degree lost.

For boiling off and heating dye stuffs, copper kettles are used, heated by steam conveyed by copper pipes from the boiler of the engine, and water is made to boil in fifteen minutes after the steam is admitted under the boilers for that purpose.

As the colors and hues are so various, it cannot be expected that I should give directions for the whole art, but the following may be found useful :

Pure water should be employed, and the proper proportions are seven or eight pounds of water to one of silk for ungumming, and the proportion of soap is about one pound to three of silk ; the kind of soap makes a difference in the result. The silk should be in convenient hanks and submitted to the boiling water in bags, or may be operated upon by suspending it on poles over the kettle, so that the lower half of the skeins is immersed in the boiling water, and the skeins should in that case be shifted by hand on the poles, so as to give to each its due degree of immersion, and the process is to be continued till the silk is wholly freed from gum.

Those silks intended for white, should be chosen from raw silk, which is naturally the whitest, and after ungumming should be wrung and sulphured, or fumigated with brimstone.

Silks intended for the dye, after ungumming, should be washed and divested of the soap, and submitted when cold to the alum bath, there to be left eight or ten hours.

The proportion of alum to be used is about forty or fifty pounds to one hundred and fifty pounds of silk, in a tub of forty or fifty buckets of water.

### BLACK.

"Take three-fourths of the weight of silk, of gallnuts, make a strong decoction of them, and boil the silk therein for a short time : let it remain in the vat for thirty six hours, then wash and wring it. The silk is so saturated with tannin, that 100 lbs. of silk thus galled, will weigh 125 lbs. Put in the bath cop-

peras and gum, according to the quantity to be dyed, heat it, dip the silk therein, and, when deeply black, put it in a trough of cold water, in which it is to be turned on a cylinder; then pass it through cold soap suds. As the price of Aleppo galls is high, white galls are often used, in the proportion of eight or ten parts of nuts to two parts of Aleppo galls.

The liquor must not boil; add more or less gum and iron solution; and when the gum is dissolved, and the liquid nearly boils, it is left for one hour, the silk, divided into three portions, is then immersed; each portion in succession. The silk is lightly wrung three times, and aired each time. The great point of this operation is to press out the liquor with which the silk is impregnated; and when it is drained, to fill it again therewith; and, above all, to expose i to the air, which deepens the color. After each por tion of silk has been wrung three times, the vat is to be heated and more gum and copperas added as at first. The reheating of the vat is called giving a fire. Two fires are commonly given for a light black, and three for a deep dye; and sometimes the silk is left in the vat, after the last fire, for twelve hours.

### BEST BLUE.

Take filings of copper, free from alloy of other metals, and put them into a glass vessel, and then pour upon them muriatic acid, sufficient to cover them twice as deep as the space they occupy. Let them stand for the space of twenty-four hours, or as long as necessary, for the muriatic acid to attain a blue or deep green color. Then pour off the clear part of the colored muriatic acid into another glass vessel, and add fresh muriatic acid to the copper filings, and continue this process until the whole of the copper filings have been dissolved, when nothing but the earthy and impure parts will remain.

Mix all these several blue or deep green colored solutions of copper, and add thereto as much spirits of ammonia, as will saturate the mixture. The silk

is then to be moistened with warm water, care being taken that all parts be completely and eqnally soaked in the water, and wrung out. It is then to be steeped in the blue tincture, prepared as above directed, and occasionally stirred, until it takes a handsome ultra-marine color. It must then be wrung, rinsed in a running stream and dried in the shade. This makes a beautiful blue, but cannot be called a fast color, as exposure to the sun will give it a greenish tint.

### DARK BLUE.

Powder very finely, and sift one and a half ounces of indigo, and put three quarters of a pound of oil of vitriol in a stone jar; add the pulverized indigo to it, stir the whole well with an earthern pipe stem, or some similar earthern article, and continue the stirring until the oil of vitriol ceases to ferment; the mixture having become quiet, set it by for the space of twenty four hours; at the expiration of this time, a little water must be added, and the whole matter stirred again, by which it will receive, as it were, new life and vigor; after which, it must be set away undisturbed, until it is to be applied to the dyeing of the silk. After this, prepare a kettle with eight buckets of water, put into it one and a quarter pounds of alum, and dissolve it completely therein. This being done, pour the solution into a pail, steep the silk in the solution, and work it well therein for an hour; after which, take it out, wring it, and lay it by, in its wet state, for further use.

This being done, put eight buckets of water in a kettle, pour the solution of indigo into it, and mix it well by stirring; work the silk well in this blue liquor for the space of half an hour, then take it out, rinse it in running water, wring it, and lay it by, in its wet state, for further use. By this process, the silk will receive a handsome light blue color.

To deepen this blue, or to change it to a dark blue, proceed in the following manner: Take a kettle

with sixteen buckets of water, and bring it to a boiling state ; then put into it four pounds of logwood, and boil it well for about three quarters of an hour ; then take out one half of the liquor, and run it through a sieve into a tub ; let the other half, or eight buckets of the same, remain in the kettle for further use ; put into the liquor in the tub, a quarter of a pound of alum, which has previously been dissolved in some vessel ; stir the whole well, steep the light blue silk in it, and work it well in the liquor a quarter of an hour ; then take it out, wring it, and keep it, in its wet state, for further use, and throw out the liquor as useless.

Lastly : pour into another vat the remaining eight buckets of the logwood liquor left in the kettle, after first having run it through a seive ; steep the silk in the liquor, and work it well therein for the space of half an hour ; then take it out, rinse it in running water, wring and dry it. By the above process you will obtain a dark blue, in every respect equal to any of the blues which have been colored by means of the keep.

The above blue is likewise applicable to the dyeing of any other goods ; and not alone in this respect, is it of advantage, but it likewise saves you the trouble and expense of preparing a keep for dyeing a small quantity of silk to a dark blue ; and if the risk of missing a keep, and the consequent loss thereof be taken into consideration, the above receipt is of considerable advantage to the dyer as well as to the manufacturer ; particularly as the smallest quantity may be colored, equal to the coloring of a keep, by reducing the ingredients in proportion to the quantity of the silk, which is to be dyed.

### A CITRON YELLOW.

Put ten buckets of fresh water in a kettle, add eight pounds of safflower, and a quarter of a pound of alum, let it boil for half an hour, run the decoction through a seive into a vat, steep the silk in the li-

quor, work it well therein a quarter of an hour, wring and dry it, fix it on the wringing post, wring and beat it well.

With the rest of the above liquor, a pale yellow may yet be dyed.

### A CITRON YELLOW, IN ANOTHER MANNER.

Pour into a kettle ten buckets of fresh water, and put 6 pounds of ground Quercitron into it ; boil this one hour, take it out, run the decoction through a sieve into a pail, immerse it in the liquor, and work it well one hour in the same ; after which, it is to be taken out, wruug and dried ; fix it on the wringing post, wring it again, &c., when it will have acquired a beautiful citron yellow.

### A HANDSOME CRIMSON.

Take 3 lbs. of Roman alum, ½ ounce of argol, ½ lb. of East India galls, 25 ounces of cochineal.

Heat eight buckets of rain water in a kettle, lukewarm ; put into it three pounds of Roman alum, dissolve it therein, take out the solution, and put it into a pail ; immerse the silk in the solution, and work it well therein for the space of eight hours.

Take it out at the expiration of this time, wring it lightly, and lay it by for further use, in its wet state.

To complete this color, heat eight buckets of well or spring water, until it begins to boil ; put into it the following articles : half an ounce of argol, and half a pound of finely pounded East India galls ; let the whole of these articles boil well for about ten minutes, and run the liquor through a sieve, into a pail ; then pour the liquor back into the kettle, and put into it twenty five ounces of pulverized cochineal : let it boil ten minutes more, cool the liquor with half a bucket of water ; immerse the silk in this liquor, and work it well therein for the space of two hours ; during which time, the liquor must be kept at a continual boil. This being done, take it out, rinse it well, wring it strongly, and dry it.

Then take a kettle with ten buckets of spring or well water, and heat it so that you may bear your hand in it; work the silk well in this water for half an hour, then take it out, wring it, and dry it. By this process, we obtain a very handsome crimson.

### A DEEP RED.

Take 1 lb. of fine galls, 2½ lbs. of alum, ½ lb. of composition, and 5 lbs. of madder.

Put into a kettle eight buckets of water, and one pound of fine galls; let it boil about fifteen minutes, or until the strength is extracted; take it out, run it through a seive into a vat, steep the silk in this decoction, and work it well therein for about two hours: after which, take it out, rinse, and dry it. Then put into a kettle eight buckets of water, with two and a half pounds of alum, and half a pound of the composition; let these be properly united with the water; pour the liquor into a vat, steep the silk in the solution, and work it well therein for the space of four hours; take it out, rinse it, and lay it by, in its wet state, for further use.

Lastly. To complete this color, put in a kettle ten buckets of water; add five pounds of madder, and work the silk well in this liquor, until it begins to boil; then take it out, rinse, and dry it.

### A REAL BROWN.

Take 6 ounces of annatto, 1 lb. of potash, 3 lbs. of alum, 5 oz. of fine galls, ¼ oz. of cream of tartar, 2 oz. of tumeric, and 10 oz. of cochineal.

Boil a kettle with ten buckets of water, powder six ounces of annatto, and put it, together with a pound of potash, into the kettle; boil for a quarter of an hour, pour the liquor through a sieve into a tub, immerse the silk, and work it well in the liquor for the space of two hours; then take it out, rinse, ring, and dry it. After this, pour eight buckets of fresh water into a kettle, add three pounds of alum, and dissolve it therein; then put the solution in a

vat, steep the dried yellow silk, and work it well therein for the space of three hours, then take it out, wring it, and lay it by, wet, for further use.

This being done, prepare a kettle with eight buckets of water, and bring it to boil; put into it ten ounces of cochineal, and let it boil for about ten minutes; then cool the liquor with a bucket of water, and put into it a quarter of a pound of cream of tartar, and two ounces of tumeric, and stir the whole well; then steep the silk, previously alumed, in the liquor, work it well therein for the space of two hours; during which, it must be kept at a continual boil. This being done, take it out, rinse it in running water, wring it, and lay it by, in its wet state, for further use.

This being done, dye it in a keep, [dye tub] light or dark, as your taste may be, or according to the pattern which is laid before you.

If you do not wish to make use of the keep, or, as is often the case in small dying establishments, should you not possess one, you may apply the indigo coloring.

You may likewise color it in the liquor of logwood, which will render it equally handsome, but not of so lasting a color.

### A NANKEEN.

Take 2 lb. of fine galls, 1½ oz. annotto, 4 oz. of potash, and ½ lb. of soap.

Put one pound of finely powdered galls in a kettle of eight buckets of water, and boil it about ten minutes, then take out the liquor, and run it through a sieve into a pail.

While thus employed, let half a pound of soap be dissolved in a bucket of warm water, and pour the solution into the liquor of the galls.

Then put into a crock with water, one ounce of annatto, and four ounces of potash; boil for half an hour, add the one-half of it to the liquor of the galls in the pail, and stir the whole well. This being done,

steep the silk in the liquor, and work it well therein for a quarter of an hour. Examine the silk, and should it not have the necessary redness, add as much of the annatto liquor to it as you may deem necessary, to give the color the desired tint. Then put the silk in again, and work it well for a quarter of an hour; take it out, rinse and dry it.

The Nankeen colored silk must not remain long without being raised, as this would create stains in it.

### A GREEN.

Take 1½ lbs. of alum, 1 lb. of potash, and 8 lbs. of tumeric.

The silk must be first dyed in a cold keep, to a handsome light blue; but caution must be used to lay the colour equally throughout the whole of the silk, and that no stains remain in any part of it; rinse it in running water, wring it, and lay it by, wet, for further use.

Immerse the silk in warm water, in such a manner, that it will be equally and uniformly saturated with the water; then wring it, and lay it aside, in its wet state, for further use.

After this, prepare a kettle with eight buckets of water, put into it one pound of potash, and one and a quarter pounds of tumeric, and let the whole boil well for about ten minutes; then pour the liquor through a sieve into a vat, steep the silk in the liquor of the potash and tumeric, and work it well therein for the space of half an hour. At the expiration of this time, it must be taken out, wrung, and put by for further use, in its wet state.

Lastly: put into a kettle with eight buckets of fresh water, one and a quarter pounds of alum, and dissolve it therein; then pour the solution into a tub, and work the silk well therein for the space of a quarter of an hour, which will change it to a handsome green; then take it out, rinse, and wring it, dry it in the shade.

(F.)

## THE SILK MILL AT DEDHAM, MASS.

As this was the first mill of any considerable size which was set up in the United States, it may be well to give some description of it.

The building is made of three stories above the basement, which is of stone one hundred feet by forty. It is situated in the outskirts of the village, convenient to the help which chiefly consists of young girls whose parents reside in the village. It is near to the Dedham Branch Railroad, being about ten rods south of the depot. There is a never failing stream of pure water running the whole length of the building on the easterly side.

The basement story contains the engine, which is of seven horse power, requiring an expenditure of about three dollars per day for coal to keep it in operation. Here also is the dyeing and reeling establishment, the repairing shop, and press room.

In the second story is the spinning room, containing sixteen throwing machines, of one hundred spindles each, the counting room, and room for putting up silk.

In the third story is the winding room, containing eighteen winding frames, and also, a room for drying and skeining silk; in the third story are the doubling frames, and pressing machines, hand looms, &c.

In this establishment has been manufactured about $30,000 of sewing silk during the past year, and also a considerable quantity of narrow goods, but owing to the scarcity of the raw material and other causes, the whole establishment has not been in full operation.

There is another large mill at Northampton, and one at Nantucket, one at Hartford, Conn., two at Mansfield, Conn., and several other smaller establishments in differents parts of the United States.

(a.) VALUE OF SILK IMPORTED AND EXPORTED FROM SEPT. 30, 1831, TO SEPT. 30, 1836.

| | 1831. | 1832. | 1833. | 1834. | 1835. | 1836. |
|---|---|---|---|---|---|---|
| IMPORTED. | | | | | | |
| Raw Silk, - - - - - | $88,557 | 48,938 | 135,348 | 78,706 | 10,715 | 37,507 |
| Manufactured Silk from India, - | 1,804,318 | 2,567,198 | 1,566,916 | 1,494,013 | 1,223,971 | 1,747,106 |
| Do. from other places, | 8,398,347 | 5,899,139 | 7,439,640 | 804,035 | *14,984,584 | *20,331,896 |
| Sewing Silk from India, - - | 52,687 | 129,134 | 42,504 | 31,121 | 39,227 | 83,542 |
| Do. from other places, - | 649,041 | 552,241 | 251,796 | 297,808 | 350,201 | 629,633 |
| | $10,992,950 | 9,196,650 | 9,436,204 | 2,705,703 | 16,608,698 | 22,899,684 |
| EXPORTED. | | | | | | |
| Raw Silk, - - - - - | $134,376 | 48,800 | 66,456 | 139,256 | 4,114 | |
| Manufactured Silk from India, - | 412,214 | 639,563 | 644,321 | 473,946 | 479,693 | 478,769 |
| Do. from other places, | 614,936 | 624,415 | 594,312 | 405,396 | 268,524 | 275,885 |
| Sewing Silk from India, - - | 6,475 | 10,491 | 7,376 | 4,102 | 5,665 | 8,446 |
| Do. from other places, - | 7,995 | 14,804 | 20,407 | 2,552 | 11,794 | 1,630 |
| | $1,175,996 | 1,337,073 | 1,332,872 | 1,036,058 | 758,900 | 762,730 |
| In addition to the above, the following values of Silk and Worsted goods were imported and exported, viz.: | | | | | *Manufactured Silks imported in 1835—36, from other places than beyond the Cape of Good Hope, were free of duty. | |
| In 1833, imp. $339,824, exp. $1,891. | | | | | | |
| 1834 do. 51,766 do. — | | | | | | |
| 1835 do. 993,377 do. — | | | | | | |
| 1836 do. 3,179,023 do. 322 | | | | | | |

*Treasury Department, Register's Office, Dec.* 21, 1837. (Signed,) T. L. SMITH, *Register.*

(H.)

## SILK CONVENTION AT BALTIMORE.

In December, 1838, a large convention of the silk growers and manufacturers of the United States was held at Baltimore. Here were assembled from different states about two hundred persons, who had directed their attention to some part of this growing interest. From a comparison of views, and the results of different actual experiments, it was fully ascertained, that the mulberry tree would flourish in every state in the Union, and that the soil and climate were propitious for the cultivation of silk. In order to give uniformity and currency to the American raw silk, it was resolved by this convention, to recommend in all cases the Piedmontese reel, or one combining the principles thereof.

The reels which I have in use, and for sale at the price of ten dollars each, combine these principles, and are found to answer all purposes of drawing the silk from the cocoons in a manner adapted to the use of our own manufacturers, and for the foreign market.

Much useful information was elicited, and many important results brought forth by this meeting. After an interesting exchange of views, and exhibition of productions, the convention finally resolved itself into a national silk society, to meet annually at the city of Washington, D. C., in the month of December. Any person recommended by a member of this society may become a member for life, by signing the constitution and paying into the treasury any sum not less than twenty dollars.

The whole doings of this convention will soon be published and circulated in a pamphlet form.

(I.)

## USEFUL DOMESTIC MACHINES.

Several useful domestic machines have been invented for silk among which are the following as described by the inventors.

*A Description of the Silk Spinner and Twister, invented by Jonathan Dennis, Jr. of Portsmouth, R. I., and for sale by him, for which a patent has been granted.*

This machine is so constructed that one person can tend and operate it and make sewing silk or twist directly from the cocoons, and spin and double and twist it at the same time, or prepare it for weaving; so that after it comes from this machine it is ready to be cleansed, and after it is cleansed it will be fit to put in skeins of white silk or sticks of twist. The person who tends it can turn it with their feet while they tend the cocoons, and keep the threads of a uniform size with their hands; and there is a fast and loose pulley for a belt to carry it by steam, water, or any power that may be applied. There is a copper boiler furnished with this machine made with a cavity under it for the fire, so that the water is over and upon each side of the fire, consequently it takes very little fuel. This boiler has a zinc steamer (that will not rust), that fits into it to keep the chrysalis from sinking, and to remove the cocoons from the water when the reeling is stopped, and to take up the cocoons and pick out the chrysales to prevent their making the water foul. This strainer has partitions in it to keep the cocoons for each of the three threads spun by themselves; these partitions may be taken out when it is time to finish off reeling for the day. As the threads become too small, one thread should be stopped and joined to the other two; and when the two become too small, one should be stopped and added to the other. When those that are stopped are added to the others, they

should be added a small part at a time, so as not to make the thread uneven. When this becomes too small it must be stopped, and the remaining cocoons taken out of the water and dried. They may be put in again and finished off when you have nearly done spinning the next time. To commence spinning, fill the boiler with soft clean water, and make a fire under it; when the water is hot enough, put in the cocoons, press them under water to soak a little, then gather the ends or fibres, and take them up between the pointed wires and guide; then take a small wire hook and draw them through the end of the spindle, take them along the tin cylinder and wind the end of the thread round the bobbin a few times, then drop it into the notch in the end of the cylinder. The two outside spindles and the middle one must all be served alike; then turn the crank up and a little past the centre, to the right hand if making sewing silk, and to the left if making twist, then press it down with your foot; and when it comes round and begins to descend, press it down again, at the same time taking care of the cocoons with the hands, and as they wind off and the thread becomes smaller new fibres should be added, which may readily be done by taking hold with both hands, and, as the thread is twisted as soon as it passes the first guide, put the left hand above the guide, holding the right hand below, and breaking the fibres by raising up the left hand, at the same time pressing the thumb down against the thread, and that will unite the fibres thus broken to the thread so that it will not show where they are joined. The pointed wires below the guides prevent the cocoons that get tangled from being drawn up to the guide and the tangled fibres being twisted in with the others would break the end or thread of silk. Sometimes they will rise up and unwind and then fall down again, but sometimes they must be taken away with the fingers. The wires to prevent the cocoons from rising up to the guide, and the thread being twisted as soon as it passes the guide, which enables the tender to join the fibres from new cocoons with the greatest facility,—are two very

important advantages that this machine possesses over all other silk spinning machines. When the bobbins become full, the bands are slipped off and the spindle taken out, and the bobbin taken off and an empty one put in its place. A little of the silk should be unwound from the bobbin that is taken off, and wound upon the empty one put in its place, to commence again. The bobbins filled with spun silk are put upon skewers and set under the spindle box, and the threads from two, if making sewing silk, and three, if making twist, are put through the guide together, and pass over the top and round under the pulley to make them both draw uniformly, then up over the glass rod into the end of the spindle and on to the bobbin the same as when it is spun, except it is twisted the other way. When the bobbins are filled with silk that is doubled and twisted, then they are taken off, and there is a small reel furnished with the machine that winds it into skeins of a proper size to sell. When it is taken from this reel it may be cleansed and knotted into skeins or colored. There is attached to the machine a belt guide, that is operated by the foot of the tender, when the machine is driven by steam or water power, so that a slight motion of the foot will stop and start the machine at pleasure. Any person can learn to tend this machine in two or three days; it is very simple and not liable to get out of order in a great while, with good usage, and any person with a little experience in tending it, would be able to manage it themselves. The machine is 4 feet 2 inches high, 26 inches wide, and 31 inches long, and weighs when complete about 100 pounds. When turned by the foot will make about two hundred skeins per day, and if turned by water or steam power they might make three hundred skeins per day ready for cleansing.

There was a gold medal awarded to J. Dennis, Jr. for this machine, by the American Institute of New York.

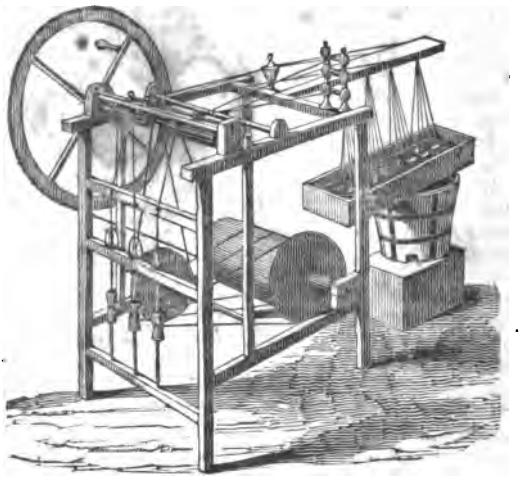
*A Description of the Improved Contra Twist Silk Reel invented by Jonathan Dennis, Jr., of Portsmouth, R. I., and for sale by him, for which a patent has been granted.*

This reel possesses several important advantages over the reels heretofore used, some of which are the following: It is turned by the feet of the tender, thus saving the labor of an additional person, and leaves the hands of the tender at liberty to tend the cocoons, and if any disorder occurs they can stop it instantly, by removing the foot from the treadle to a lever by the side of it; and the person tending the cocoons turning the reel themselves, have it more under their own control than if it was turned by another person. There is a twist given to the threads of silk reeled, by two revolving tubes as soon as it passes the first guide. This twist enables the tender to join additional fibres from new cocoons with the greatest facility, and thus keep the threads of a uniform size. This twist escapes before the thread is wound upon the reel, and two threads are reeled at once. The advantage of twisting the threads reeled by running them through a revolving take, is very great; it saves a great deal of trouble and time when the reeling is commenced, and the threads are not half so likely to break in reeling, and if one thread breaks it does not break the other, and if the thread should break, it is not half the trouble to start it that it would be if the twist was given by one thread running round the other, as is done in the old method.

There is a set of pointed wires that prevents the cocoons that do not unwind from rising up to the guide and breaking the thread. There is a copper boiler to this machine with a cavity under it for the fire, so that the water is over and upon each side of the fire, consequently takes very little fuel. This boiler has a zinc strainer fitted into it, to prevent what remains after reeling from sinking, and to remove the

cocoons from the water after the reeling is stopped, and to take up the cocoons occasionally and pick out the chrysiles to prevent the water from getting foul and making the silk dark colored. To commence reeling, fill the boiler with clean soft water, and make fire to heat it sufficiently but not so as to boil; put the cocoons into it and press them under water, and let them soak a few minutes, then gather the ends from as many cocoons as will make the thread of the size desired; draw it up between the pointed wires and guide, and with a small wire hook draw it through the tube, then through one of the guides in the traversing rail, and make it fast to the arm of the reel, then with the foot turn the reel, and as the thread becomes smaller add to it by gathering the ends from new cocoons, and joining them to the thread that is running. While it is in motion, take the fibres in the left hand and draw them up, then take hold with the right hand five or six inches below and break them, holding that part of the thread between the guide and breaking it by raising up the left hand, and pressing the part broken off down to the thread that is running, with the thumb, and that will join them so that the place where they are joined will not show in the thread. One person can reel more silk upon this than two can upon any other reel heretofore used, and reel it as well in the same time. This reel is 4 feet high, 2 feet wide, and 5 feet long, and weighs about 100 pounds, with a boiler and all the apparatus complete. This reel is very simple in its construction, and not liable to get out of order. There was a gold medal awarded to J. Dennis, Jr., for this machine, by the American Institute of New York.

## BROOK'S PATENT SILK SPINNING MACHINE.



Brooks's silk spinning and reeling machine, is found to be a very simple and easy operating machine, and yet one of the most perfect that has been invented for the purpose of reeling and twisting silk from the cocoons, and manufacturing it into sewing silk. By the different arrangements of this machine, it will operate upon a single or double thread, as may be required, and prepare it for twisting or weaving. Experience has fully proved that by uniting the filaments of silk as they are drawn from the cocoons, wet in their natural glutinous substance before they are dry, the thread is more firm, smooth and stronger. The simplicity of the machine, and the very easy way in which it is used, brings it within the comprehension and capacity of any person to use it.

This machine is so constructed as to draw, or reel and twist the silken fibre immediately as it passes from the cocoons; and thence makes it into warp or filling for weaving, or into finished sewing silk or twist; each of which is made by one movement of the machine at the choice of the operator.

LIST OF AUTHORS AND PUBLICATIONS ON SILK.

A Treatise of Dr Pascalis, of New York, on the Mulberry Tree and the Culture of Silk; also his Silk Culturist, formerly published in New York.

American Silk Grower's Guide, by Wm. Kenrick, Esq., a valuable work by a most excellent cultivator.

Works of Comte Dandolo and M. Bonafoux, of Piedmont.

Dr Rush's Silk Manual, drawn up by order of the Secretary of the Treasury.

"Summary of the Principal Chinese Treatises on the Culture of the Mulberry, and the rearing of Silkworms." Translated from the Chinese into French by Stanislaus Julien. Transmitted from Paris to the Secretary of State, and rendered into English by Peter Force, Esq., Mayor of the city of Washington.

Chinese Volume of Splendid Descriptive colored Engravings in Quarto, representing the Chinese Process of Cultivation and of raising Silk.

Cours Complet D'Agriculture, a most complete work, published at Paris.

Annales de L'Institut Royal Horticole de Fromont by the Chevalier Soulange Bodin, in 6 vols., from 1830 to 1835. Paris.

A Treatise on the Origin, Progressive Improvement, and Present State of the Silk Manufacture. By Dr Lardner. A most valuable and late work.

Philosophy of Manufactures. By Dr Ure. London. 1835. A most valuable work.

Silk Manual compiled and written by E. P. Roberts, Editor Farmer and Gardener. Baltimore, 1835. A valuable work.

A Valuable Manual on Silk, by Judge Comstock; Hartford, Conn. 1836.

Also, the Silk Culturist, a valuable periodical by the same writer.

The Silk Worm, a valuable periodical edited by S. Blydenberg, of Albany.

The Silk Manual, another excellent periodical, edited by the late Thomas G. Fessenden, of Boston.

The American Silk Grower is another valuable periodical, edited by Messrs. Cheney, of Burlington, N. J.

Gideon B. Smith, Esq., formerly editor of the American Farmer, printed at Baltimore, has done much in aid of the cause by his writings in that periodical, and also by a manual he has published.

A volume of Essays by Peter S. Duponceau, LL.D. and Mr D'Homergue, published in Philadelphia.

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